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APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

HYDRAULIC DRIVE FOR TRANSFER CAR 65

PRESCRIPTIONS FOR OIL 67

HYDRAULIC INDEXING FOR CIRCUITS 71

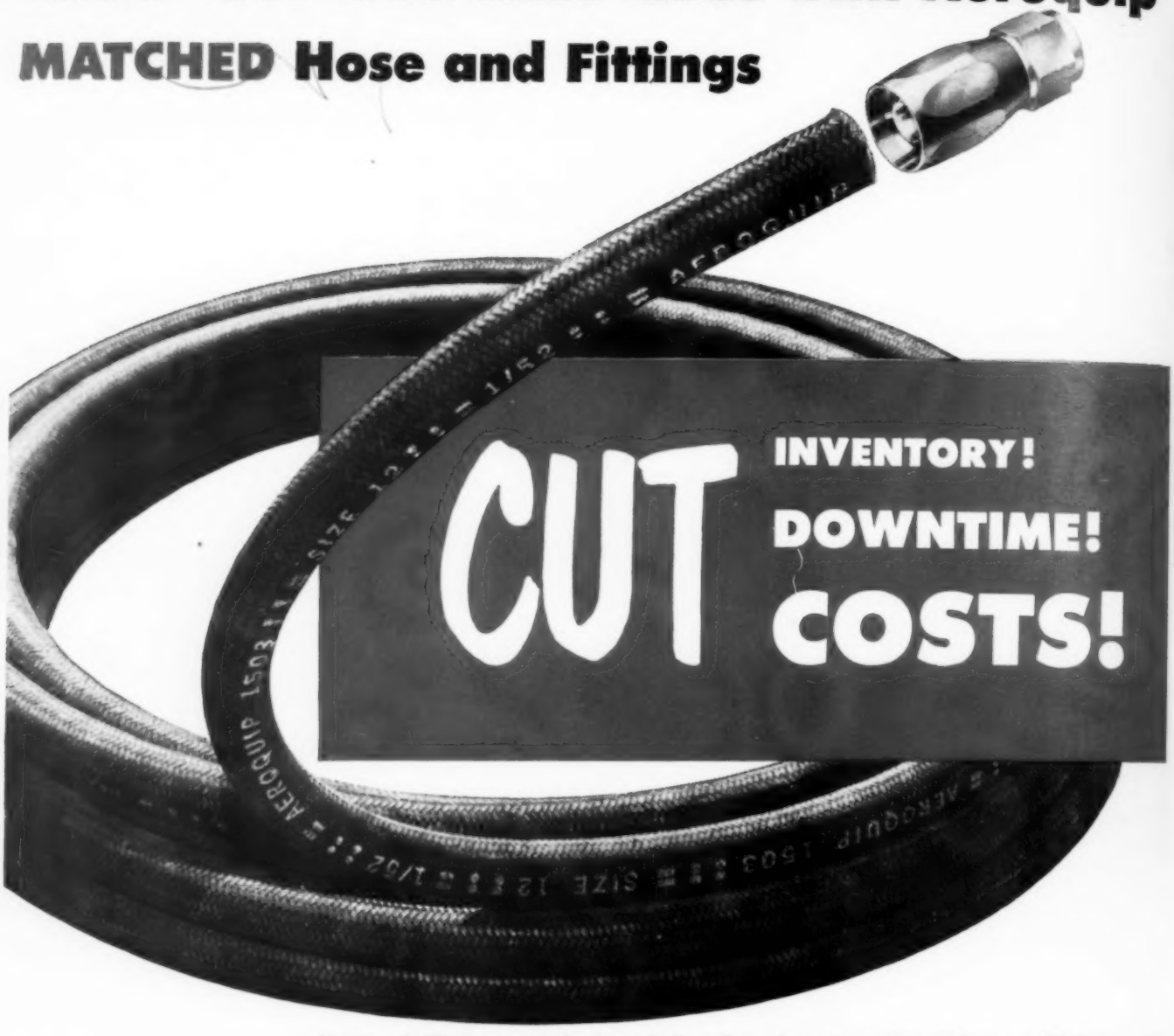
DESIGNED TO SAVE AIR 78

USING PRESSURE RELIEF VALVES CORRECTLY 89

Listed on page 2 you'll find 15 articles and 7 regular departments which feature application and design ideas for fluid power equipment

Make Your Own Hose Lines with Aeroquip

MATCHED Hose and Fittings



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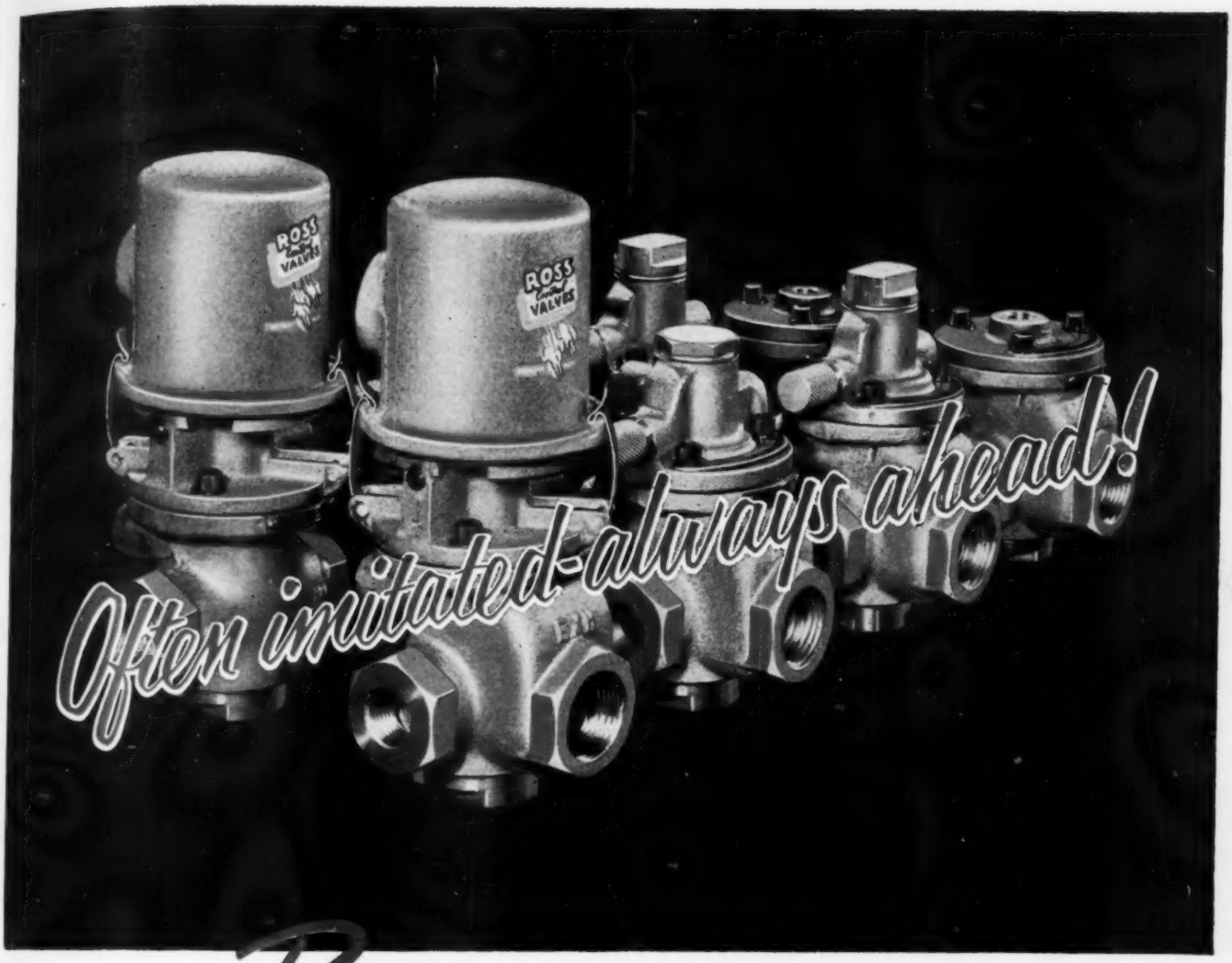

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MAY, 1953
Vol. 6, No. 5

APPLIED HYDRAULICS

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Published monthly, acceptance under Section 36.64 P.L.&R. authorized at Pontiac, Illinois.

Circle 78 on Reader Service Card

Electronic spacer patterns guide stockpile through sequence of cuts automatically. Responsive Oilgear Transmission provides speedy travel with pin-point stopping within 3/1000ths of an inch from zero tolerance. Lawson Cutter also used in repetitive single cuts and for trim on sides. Photo in plant of Liedtke Brothers, Chicago.

The RESULT?

Accuracy just 900% better

Production increase 50 to 500%

ver and over and over again, ilgear Fluid Power proves to be he right solution to a drive problem. ake the case of the Lawson Cutter.

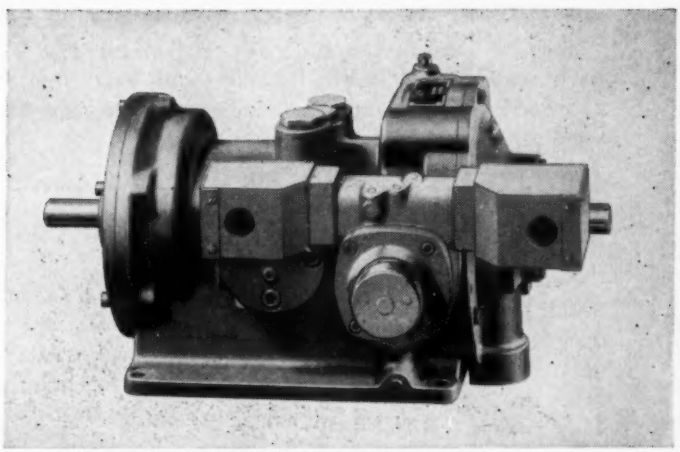
precision is emphasized anywhere, that "where" is e field of fine color printing of every description. oney, time, effort are spent that art be right, that plates e right, that printing be right—to a hairline. And then mes the cutting operation where all that has gone efore is saved—or wasted. Small wonder that cutting mained a hand operation for many years.

But the E. P. Lawson Company, manufacturer of cut-g machines, wanted to modernize and mechanize the peration. Its designers turned to an electronic spacer evice. This if anything would give precision in mark-g *where* to cut. But the next problem was to find a wer drive capable of *obeying* the orders the elec-nic signal system was capable of *giving*. Lawson ed one type of drive. It varied all over the map. awson tried another type of drive. It was fairly accurate but did not hold up.

Finally, as so many machine designers have done, awson turned to Oilgear. And there, as so many achine designers have done, Lawson found the answer its problem.

The answer? Undeviating accuracy within 3/1000ths an inch from zero tolerance—just 900% better than hat had been achieved in the past; speed, translating to production increases of 50% to 500% month in d month out. How? Through the absolute responsive-ss of Oilgear Fluid Power Drive to the automatic ntrol system. Immediate, shockless acceleration to ll speed "forward". Precise measured slowdown as e feed fence nears the target. Precision stopping "on rget" for the cut and then rapid acceleration toward e next cut.

Here again is an example of the superlative "right-



Oilgear Two way Variable Speed Transmission as used on Lawson Electronic Spacer Cutters. These drives also provide unlimited speed range from zero to maximum. Speed changes made in split second or specified time.

ness" of Oilgear Fluid Power "generators," motors, transmissions—for almost any type of installation or machine requirement, big, little, and all those in between.

Chances are Oilgear is *the* solution you've been looking for. And Oilgear engineers will be just as quick to tell you if Oilgear is *not* for you. Ask for further information from an Oilgear Engineering Representative. No charge. No obligation. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

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PIONEERS ... NOW THIRD DECADE FOR FLUID POWER

Fluid Power Lines

Final Month For Prizes

If you're like us, you've put off writing your paper for the APPLIED HYDRAULICS Prize Contest to the last minute. Well, this is it. With the closing date of June 1st, you should be getting your entry in the mail. If writing is a tough job, let pencil sketches, blueprints, charts and photographs do most of your job.

The judges for the contest are Dean M. Cleaveland, Bendix Products Division, Bendix Aviation Corporation; Walter Ernst, The Commonwealth Engineering Company of Ohio, and J. R. Hemeon, Ternstedt Division, General Motors Corporation. Prizes totalling $1200 will be awarded to men in industry. Engineering students are eligible for a separate group of prizes totalling $300.

Mountain to Mohammed

Some of the large machining jobs which are presently being done on transfer machines require a great deal of design thinking on how to carry the work through the machine. This month Ken Keska, Wean Equipment Corporation's chief staff engineer, describes the hydraulically powered track riding 13 ton transfer car which carries a 4 ton hull through milling, drilling, reaming and tapping operations. A small five horsepower drive does this giant work transfer job.

Fluid Power Meetings

Engineering societies throughout the country are fast becoming aware that "Hydraulics" is much more than weirs and dams. We reported, in the past few months, the progress which engineers in the Philadelphia area have made in the organization of a Fluid Power Section. They have organized under the sponsorship of the ASME. This month in New York City an initial meeting of a similar group will be held. Such organizations indicate a growing interest and therefore an obvious need for an engineering group which regularly meets to discuss the application of oil hydraulic and pneumatic equipment.

Apart from the formation of specific local engineering groups and the growth of the annual National Conference on Industrial Hydraulics, many engineering meetings are now including papers covering the application fluid power. Many courses are being arranged within individual plants and at trade and engineering schools.

Proper application of fluid power requires an understanding of electrical controls and mechanical design, and as control problems involving servomechanisms become more important an understanding of many branches of engineering is required. The formation of Fluid Power engineering groups will greatly assist in advancing the application of air and hydraulic equipment. Such groups merit the cooperation of every engineer who is engaged in the field.

Acres of Piping

Rubber plants, such as the B. F. Goodrich Akron plant whose hydraulic power station is described in this issue, literally have piping running over acres. Because these plants went up in the days of steam driven pumps, central power stations were used. In some cases, pumps were located in departments and steam was piped from the power house to drive the pumps. Scattered pumps and steam drives are a maintenance headache, so Goodrich is modernizing the pump installation in the power house and welded piping carries 500, 1,500 and 2,000 psi water to the equipment throughout the 51 acre area.

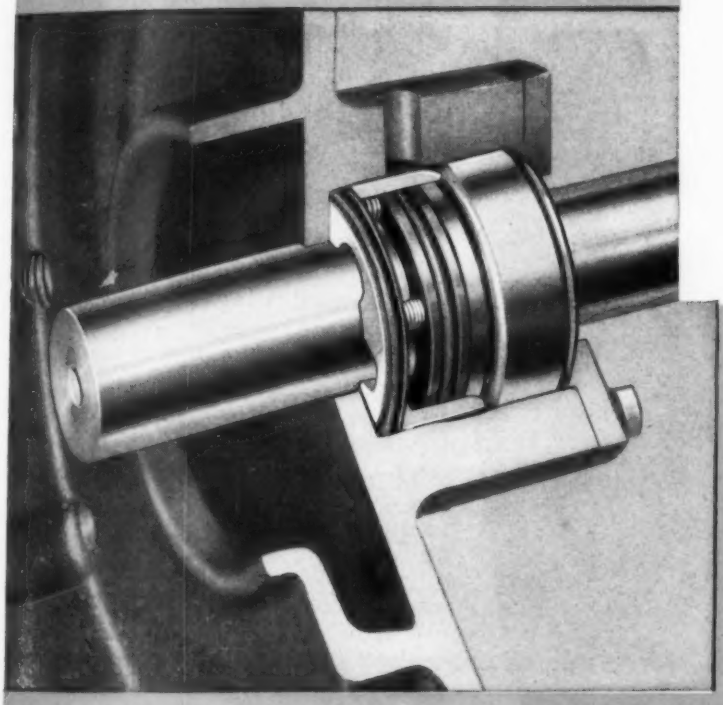
Oil Care

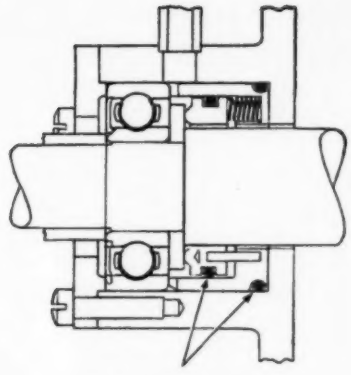
Maybe it's because we usually get oil on our shoes and a suit has to go to the cleaners after we've climbed around some oil powered equipment, that we have what might be called a vested interest in oil care. Of course if you're paying for the oil leakage and wear and tear on equipment, your investment is greater than ours.

To help reduce costs caused by improper selection of hydraulic oil, Bruce H. Dunham has written an article in this issue in which he tabulates the most suitable oil against the condition and type of hydraulic system.

A PAIR OF PRECISION "O" RINGS

makes possible this oil seal's simple design and maintenance-free performance!





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Two *Precision* "O" Rings are used in the Janette Oil Seal. This simple design is easy to assemble, requires no maintenance, and protects the vital parts of the seal from dust. The performance record of the Janette Seal is unsurpassed. Years of experimentation, lab and field tests went into its development. *Precision* "O" Rings met the tests and got the job!

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LETTERS to the Editor

Sandwich Seal

We came across an item on page 40 of your February issue that is of interest to us. It is listed as item 6 and has a photo courtesy line Dowty Seals, Ltd. We are interested in knowing whether this company has a distributor in this country and where we could get some descriptive material on their products.

RICHARD D. REEDER,
Project Engineer,
Piper Aircraft Corporation

The seal shown as item 6 on page 40 of the February issue of APPLIED HYDRAULICS is a product of Dowty Seals, Ltd. This company has an office, Dowty Corporation at 25 Beaver Street, New York 4, N. Y. An American manufacturer, Precision Rubber Products Corporation, Oak Ridge Drive, Dayton, Ohio, manufactures these seals under license in this country. Precision make seals for both aviation and industrial applications.

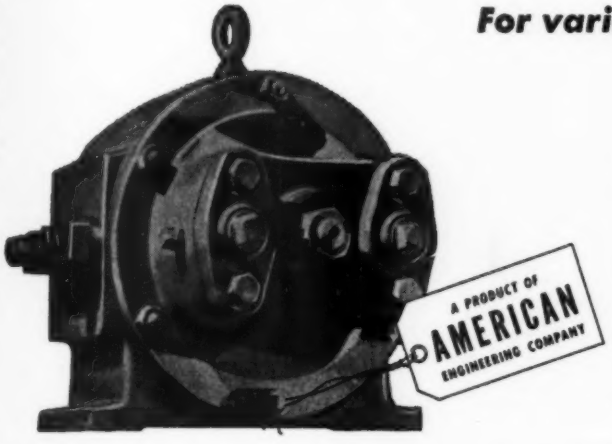
An Apology To Mr. Cooke

I wish to call your attention to several changes which were made in editing my article which appeared under the title of "Suggestions for Leakage Control in Hydraulic Systems" in your February issue. Since the article in its original form was intended to assist designers, the edited article misrepresented my views as noted. The first section was not contained in the type-script submitted to you. Obviously, this does not represent my views on toroidal seals, as expressed in my original text "the toroidal seal, although excellent in static applications, can only be used with great caution for reciprocating duties."

In the third section, the final

Continued on page 10

When it's high pressure... it's AMERICAN!



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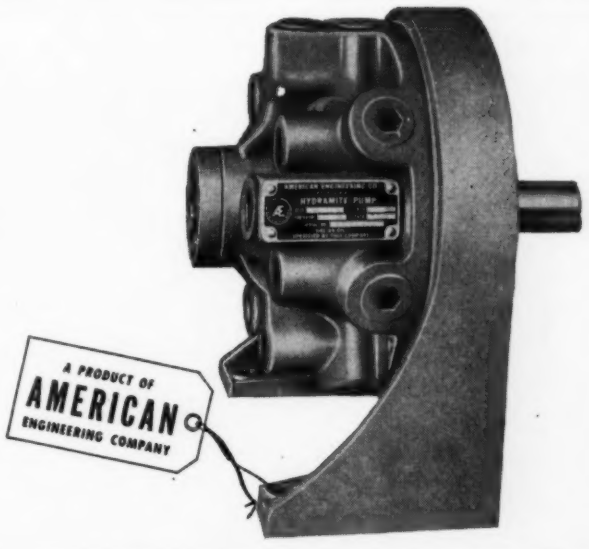
Products of American Engineering Company, the Hele-Shaw and Hydramite Pumps are outstanding in their respective high pressure ranges . . . bringing users top efficiency and economy on a vast and growing variety of hydraulically-operated equipment. Mail coupon for full information.



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simplify operation, improve control of Barber-Greene "Runabout"

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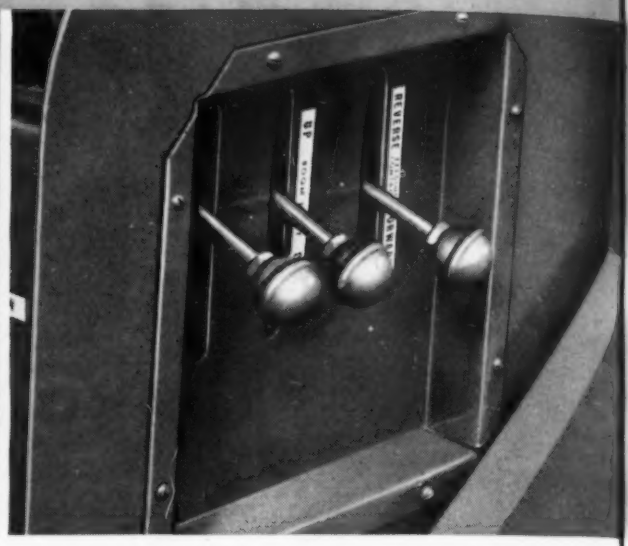

CENTRALIZED HYDRAULIC CONTROLS—conveniently located for seat or side operation. While machine is operating, ditching speeds are easily and instantly changed to meet variable digging conditions. Result—ditcher works at maximum efficiency at all times.

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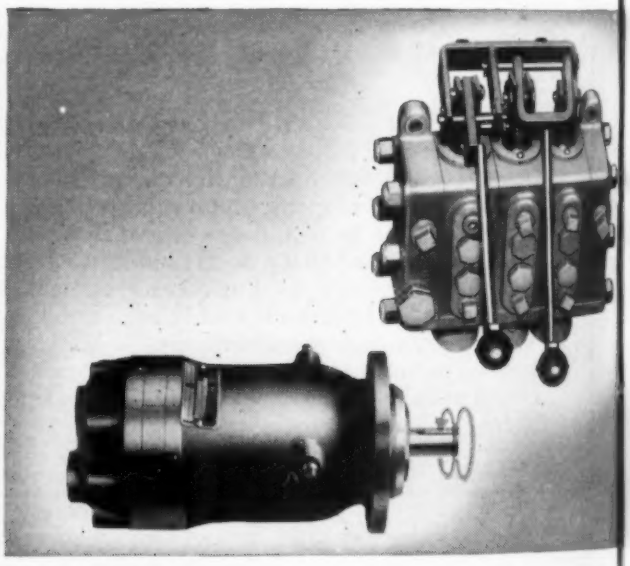

ONE COMPACT VALVE—Three sections are connected in series so various operations may be performed simultaneously under full or varying load. Sundstrand Fluid Motor is the *heart* of the "Hydra-Crowd" Transmission, providing infinite speed range and a smooth-operating, simply designed power source.

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GREER TOPICS

Important News of Greer Equipment for Aviation and Industry

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Greer Builds Complex Lube Pump Tester for Wright Aeronautical

Precision engineered from ten pages of rigid specifications to accurately test main oil pump assembly of J-65 turbojet engine

The test machine pictured above is another good example of Greer designed-to-order equipment. In this case, the customer provided specifications—in other cases, the entire test problem is turned over to Greer engineers who design and build precision equipment to do a specific job.

These out-of-ordinary problems need good men to solve them. There are *good* men at Greer with many years of this specialized experience that is difficult to find, perhaps impossible to match elsewhere.

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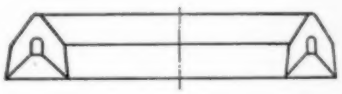
Letters to the Editor

Continued

sentence has been taken completely out of its context. The gland, no matter what type it may be, has no influence upon the flow of fluid. In my typescript I pointed out that the valve construction was interesting as, with the valve open there is minimum restriction to the flow. As to the fourth section, I made no mention of the method of securing the ferrules. I have publically made known my disapproval of welded ferrules because of stress concentrations. I prefer blazing alloy with a low melting point.

In section five, only the right hand sketch was submitted. The other illustrations show methods of fitting which have been shown to be inefficient; they are now recognized as being bad practice. The illustration of a "V" ring bears not the slightest resemblance to those to which I referred, although it does closely resemble a misshapen piece of rubber or leather. The "V"s in my illustration are scientifically designed; in the



sketch shown herewith, you will observe that the sides are tapered to insure that the lip makes initial contact with the shaft. The final paragraph of this section, which has been inserted during editing, is quite the opposite of my considered opinion regarding fitting of these packings and contradicts the preceding paragraph. I consider that a packing which fits a prescribed space and is not then subject to adjustment is more likely to seal oil, than one which is at the mercy of the plant engineer.

B. Cooke,
Vickers-Armstrongs Ltd.,
Research Department,
Elswick Works

We are extremely sorry that our presentation of the leakage control article has caused you embarrassment. We want to assure you that the editing that was done did not intend to inject opinions contrary to yours. Our usual rule of having

the author review our edited draft before publication somehow failed in your case. Each of your points is well taken.

Support for Small Fittings

I have been unsuccessful in trying to locate pipe fittings in 1/4, 3/8 or ½ inch sizes, malleable, cast, brass or otherwise, with means of self support. We have much use for fittings as such in making up hydraulic and pneumatic control panels, filters, fog lubricators and other units. To date we have been welding mounts to standard fittings, which is costly and undesirable. Can you tell us where such items can be purchased?

GEORGE E. JOHNSON,
Buffalo 10, N. Y.

Do you mean a clamp or a flange by "means of self support"? Our records do not indicate that any standard small size pipe fitting is so equipped. We will do some checking with specialists. Editor's note: If any of our readers can come up with a source of supply, we would like to know of it also.

From "Down Under"

We are endeavoring to establish a hydraulic school for the apprentices employed by our company and would appreciate receiving as much information as possible on items you think would assist us. From various issues of APPLIED HYDRAULICS we have extracted the following articles which we believe would be of interest: Beginners Course in Basic Hydraulics, Beginners Course in Basic Pneumatics, the Efficiencies and What They Mean and Know Your Component Symbols.

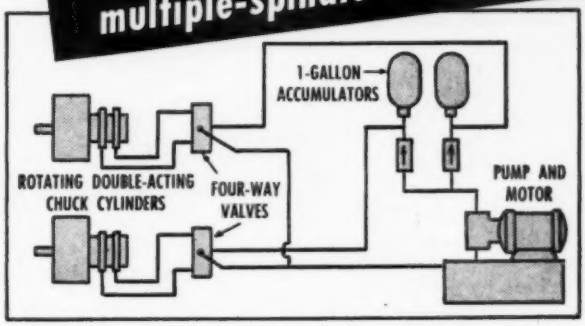
It is the intention of the writer to visit America during September or October of this year to attend the Vickers Service School and any information regarding conferences that may be held about this time will greatly assist the survey to be made of the American hydraulic industry.

We were greatly impressed by an editorial written by Mr. Irving

Continued on page 14

IMPACT for Chucking

GREER ACCUMULATORS
deliver hydraulic SURGE on multiple-spindle machines



Greer Accumulators deliver the hammer-like blow on the chuck jaws required to seize and release work on automatic multiple spindle machine tools. In the above simplified, schematic diagram the Greer Accumulator not only supplies power for actuating the chucks but also maintains line pressure for holding the work securely. A low-volume, high-pressure pump charges the accumulator during intervals between chucking. Without the accumulator, a pump to deliver the required surge of fluid would have to be so large and costly as to be economically impractical.

Let us help you to reduce the size, cost, and complexity of your equipment. No obligation. Write or phone.

Functions Performed by
GREER ACCUMULATORS

1. PRESSURE STORAGE CHAMBER to provide
   a. Main source of hydraulic power
   b. Auxiliary power source.
   c. Emergency power source.
2. PRESSURE-VOLUME COMPENSATOR for
   a. Leakage compensation.
   b. Temperature compensation.
3. DISPENSER OF FLUIDS and Lubricants.
4. TRANSFER BARRIER for Fluids and Gases.
5. SHOCK ABSORBER to
   a. Absorb line shocks.
   b. Reduce pump pulsations.

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ACCUMULATORS
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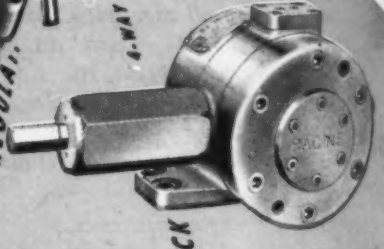

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FREE FLOW AND RESISTANCE · CHECK · 4-WAY · 2-WAY · FEED · GLOBE

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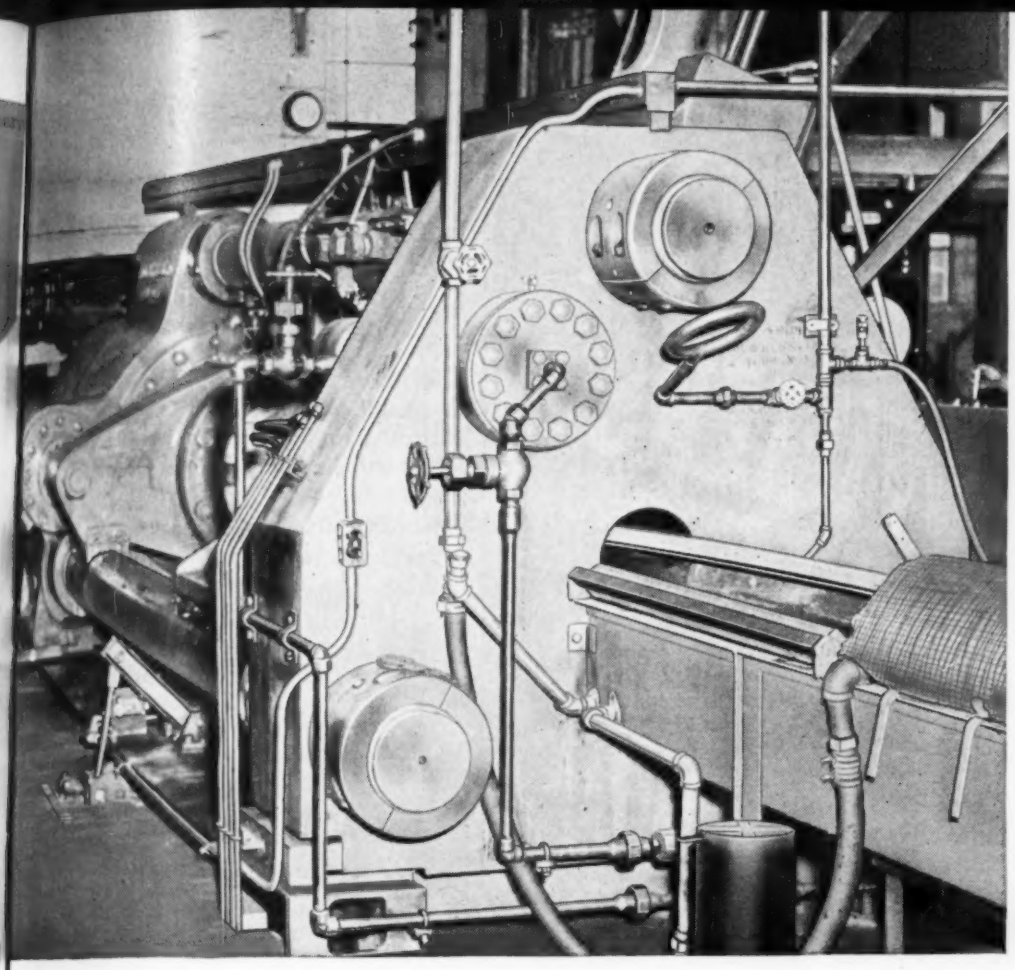

What's YOUR problem?

D. R. Clay, of Standard Oil's Grand Rapids, Michigan, office, is the lubrication specialist who has helped Light Metals Corporation keep maintenance of hydraulic units at a minimum through use of STANOIL Industrial Oil.

He is one of many Standard Oil specialists located throughout the Midwest. These men have the practical experience and special training to handle lubrication problems on any type of operation.

Take advantage of the service offered by the lubrication specialist nearest your plant. You can contact him easily by phoning your local Standard Oil Company (Indiana) office. With his help, find how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.

Steam turbines . . . freedom from emulsions and sludge, fewer oil changes necessary.

Ring-oiled bearings . . . rings function immediately on starting, less bearing wear.

Circulating and bath systems . . . one oil for a wide variety of jobs.

Puts squeeze on hydraulic press maintenance...

• Shown above is the 1250-ton hydraulic press used by the Light Metals Corporation of Grand Rapids, Michigan, for extruding variously shaped sections of aluminum. When this press was installed recently, officials gave the important hydraulic oil job to STANOIL Industrial Oil. They based that decision on their own experience with this outstanding oil.

That experience covered over four years' use of STANOIL in the hydraulic system of a 315-ton extrusion press. STANOIL has served continuously in this press without being changed or removed for oil maintenance. The hydraulic oil system has never been cleaned and has remained entirely free from deposits and varnish. Hydraulic operation has been efficient at all times.

The experience of the Light Metals Corporation is your assurance of STANOIL's ability to reduce hydraulic system maintenance to a minimum in your plant. This

STANOIL
TRADE MARK
Industrial Oil

versatile oil will provide clean, dependable lubrication for such a variety of equipment as air compressors, reduction gears, and electric motors. The Standard Oil lubrication specialists will help you make the most effective use of STANOIL. Phone him at your local Standard Oil (Indiana) office. Or write, Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

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Keep your hydraulic oils, and coolants clean with . . .

SPARKLER FILTERS

designed specifically for this purpose. A practical protection for hydraulic machinery and cutting tools

The VR filter is designed for filtering hydraulic oil, quenching oils, transformer oil, solvents and other industrial liquids.

★ Clean hydraulic oil greatly prolongs the life of all moving parts, such as pistons, cylinders, pumps, valves, etc.

★ Filtering hydraulic oil extends the life of the oil. Drain and leakage oil may be reclaimed. One large user of hydraulic machinery saved $90,000.00 in hydraulic oil alone in one year by filtering oil with Sparkler Filters.

★ Filtering hydraulic oil eliminates sticking and clogging of valves and reduces down time and maintenance cost. A prominent authority on hydraulic machinery says that 70% of servicing and repairs is due to the improper condition of hydraulic oil.

★ Filtering coolant fluid removes all fine metal particles and grit from grinding wheels that is pumped back to nozzles unless a filter is employed in cleaning up the return coolant.

★ Clean filtered coolant prevents scratching and flat spots on work piece and increases the life of grinding wheels and cutting tools. Reduces the frequency of dressing grinding wheels.

The Sumptype filter is ideal for filtering coolants. The filter plate assembly is attached to the intake pipe of the circulating pump and the coolant is drawn through the filter discs and delivered clean and free from all metal particles and grit, to the nozzels.

The Sparkler VR filter is constructed on a simple filtering principle using filter paper as a media. The filter plates can be removed easily for cleaning which consists only of removing the dirty paper and replacing with fresh sheets. Any shopman can make this change of paper in a few minutes. The cost of replaced paper is less than a dollar per change.

Let a Sparkler representative demonstrate these filters in your plant

SPARKLER MANUFACTURING CO.
Mundelein, Ill.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Letters to the Editor

Continued

B. Hexter, the President of APPLIED HYDRAULICS in the October 1952 issue, outlining the need for a trade association to assist the development of the use of hydraulics. We are endeavoring to establish a similar institute in Australia to come in line with the J.I.C. Standards as we feel much faulty equipment is coming into the Australian market and causing a swing away from the use of hydraulics.

E. S. ARCHER,
S. C. Archer Pty. Ltd.
Stanmore, N.S.W.

We appreciate your fine letter. We have sent you as many tear sheets of the Pneumatics series as are available. We are sorry that the Hydraulics series are out of print. We are also sending you an outline of a course in Industrial Hydraulics which is taught at Fenn College here in Cleveland by our Associate Editor. We are also sending you a copy of the APPLIED HYDRAULICS Data List, a bibliography of manuals and major engineering works available.

You probably will be in America during the time that the National Conference on Industrial Hydraulics will meet. This is at the Sheraton Hotel in Chicago, October 8 and 9. This is the outstanding annual meeting on hydraulics.

You will be interested in knowing that Mr. Hexter's editorial promises to bear fruit. A new National Fluid Power Association has just been announced and an organization meeting is scheduled for May 18 and 19. From the preliminary meetings that have been held, it appears likely that this Association, that eventually will include all manufacturers of pneumatic as

Readers who intend to submit an entry in the PRIZE PAPER CONTEST should ask for the Entry Blank at once. There is still time to win one of the major prizes. The Contest closes on June 1, 1953.

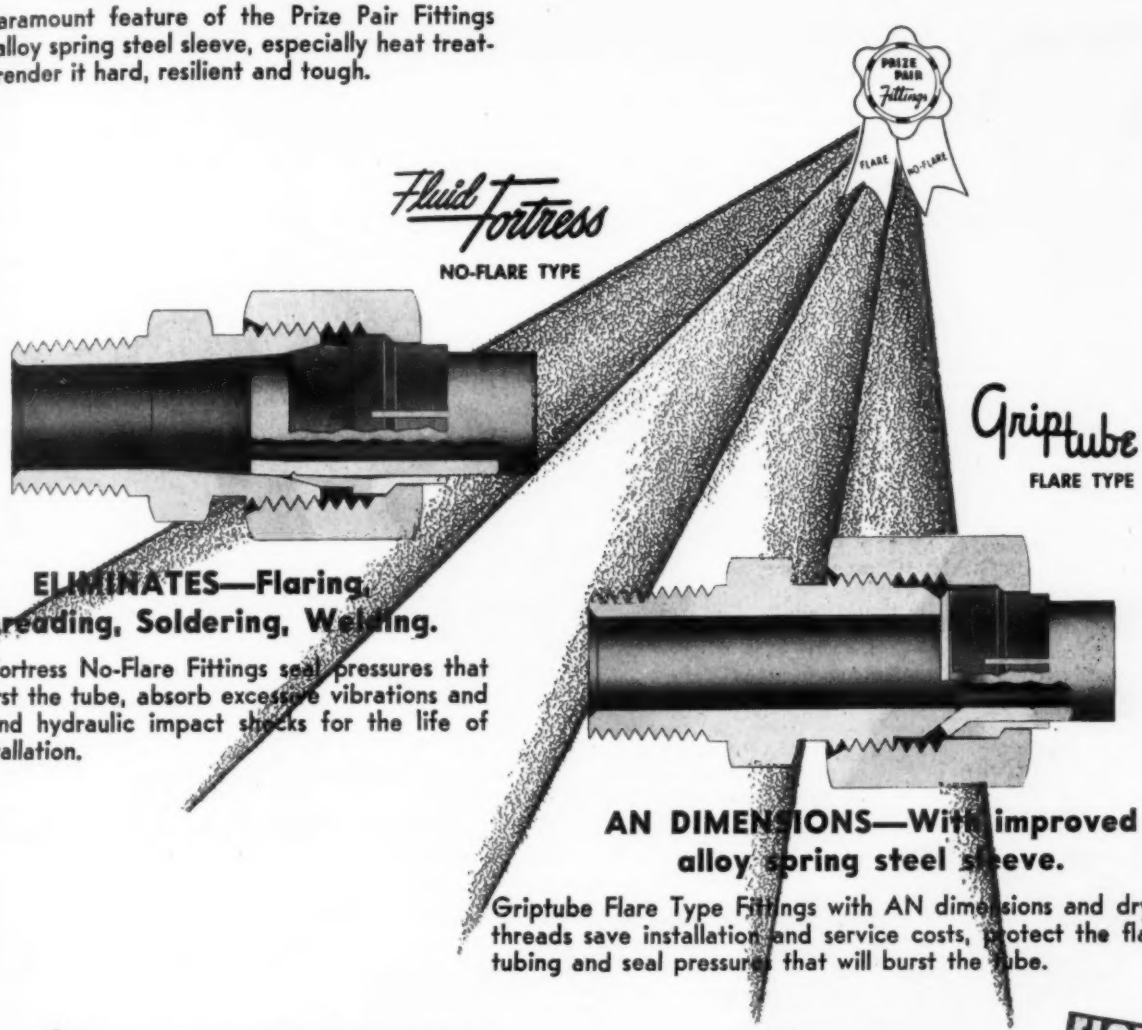
FLODAR

STANDARD (J.I.C.)

TUBE FITTINGS

PRIZE PAIR

The paramount feature of the Prize Pair Fittings is the alloy spring steel sleeve, especially heat treated to render it hard, resilient and tough.



ELIMINATES—Flaring, Threading, Soldering, Welding.

Fluid Fortress No-Flare Fittings seal pressures that will burst the tube, absorb excessive vibrations and withstand hydraulic impact shocks for the life of the installation.

AN DIMENSIONS—With improved alloy spring steel sleeve.

Griptube Flare Type Fittings with AN dimensions and dryseal pipe threads save installation and service costs, protect the flare of the tubing and seal pressures that will burst the tube.

HIGH PRESSURE STEEL PIPE FITTINGS

With Flodar Pipe Fittings the installation man can make a variety of connections involving a large reduction between pipe size and tube outside diameter.

WRITE FOR NEW 1953 CATALOG

Ask for catalog No. 553 describing complete line of tube fittings, pipe fittings and accessories. Catalog includes important engineering data, installation instructions and tubing recommendations.

FLODAR FITTINGS exceed the performance requirements of MIL-F-5506. J.I.C., section H4.1.6

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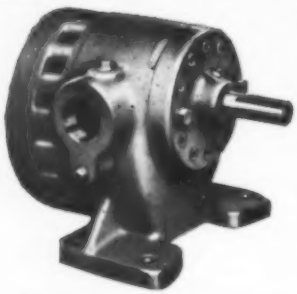
LIFT LOWER PUSH PULL

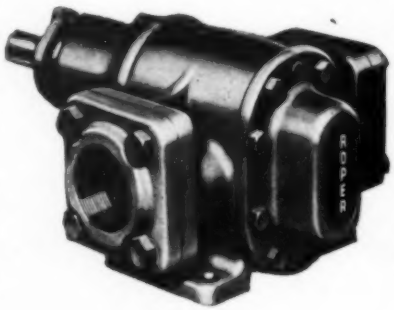
...for Dependable Hydraulic Service, install ROPER Rotary PUMPS

PRESSURES TO 1000 P.S.I.



Roper *dependable* Pumps! Smooth running units that add to the efficiency of diversified hydraulic applications. The Roper principle of only two moving parts—equal size pumping gears operating in a sturdy case with proper clearance—results in superior serviceability and promotes long life. The Roper Pumps illustrated are representative of standard pumps suitable for most installations. For unusual applications, let Roper engineers work with your design engineers in developing a special Roper to fit your needs.

SERIES H . . . Pressures to 1000 P.S.I.—Capacities 10 to 75 G.P.M. Spur gears operate in axial hydraulic balance . . . roller bearings and bronze wear plates reduce friction under heavy loads . . . splined drive shaft absorbs thrust loads. Most models can be direct connected, belt, or gear driven. Packed box or mechanical seal.



SERIES K . . . Pressures to 150 P.S.I.—Capacities ¾ to 50 G.P.M. Compact, yet sturdy enough to handle a wide range of jobs. Self-lubricated by liquid being pumped . . . handle total suction lifts up to 25 feet . . . come equipped with mechanical seal or packed box, with or without relief valve. Easy to install and apply.

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SERIES F . . . Pressures to 300 P.S.I.—Capacities 1 to 300 G.P.M. Popular pumps that feature 4-port design (eight optional piping arrangements, 4 for clockwise and 4 for counter-clockwise rotation.) Supplied in standard or stainless steel fitted models to suit specific needs. Furnished with or without relief valve, with mechanical seal or packed box. Ideal for hydraulic power generation in a wide range of applications.

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Letters to the Editor

Continued

well as hydraulic equipment and the accessory manufacturers, will be a going organization by fall.

Powered Flying Control System

On page 86 of your September 1952 issue there is described a simple powered flying control system shown diagramatically as Figure 3. Could you suggest possible sources for this valve and piston arrangement?

JOHN S. SCHROEDER
Schroeder Brothers

The full powered flying controls system shown in Figure 3 on page 86 of the September, 1952 issue of APPLIED HYDRAULICS is a simple servo valve and piston arrangement. While the actual system described was on a British aircraft, hydraulic manufacturers of valves that specialize on aircraft equipment can help you. We suggest you get in touch with several of the hydraulic valve and hydraulic cylinder manufacturers listed under Aviation Products in the 1953 Directory (pages 222 and 210 of the January issue of APPLIED HYDRAULICS).

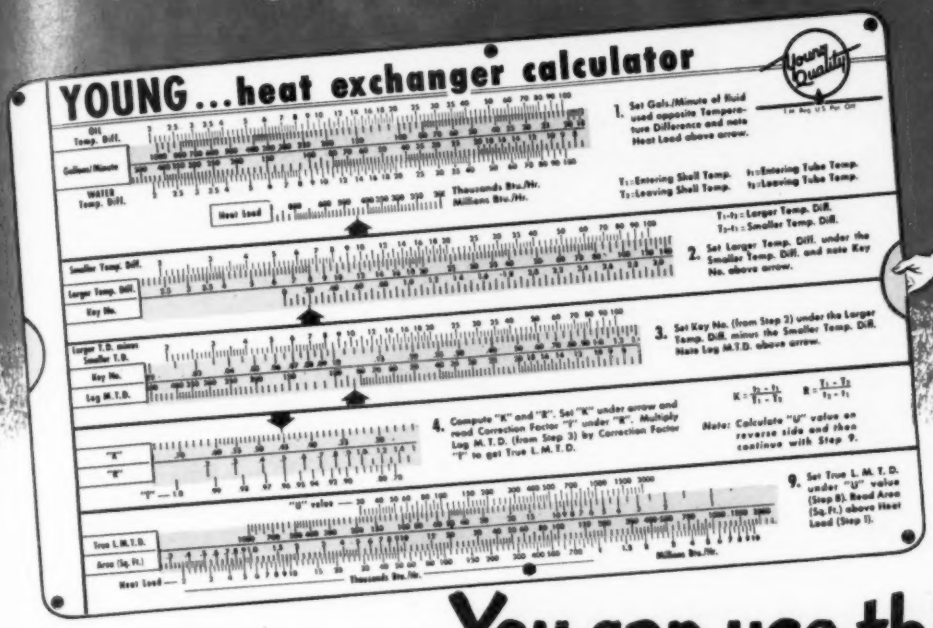
Oil Powered Coil Stacker

It has been called to my attention that you described an oil powered coil stacker on page 41 of your February, 1953 issue. Our company is just initiating the promotion of a new parking device in which we have certain hydraulic problems in connection with a dump truck hoist which we use instead of an elevator. It looks as though the device described in your article might be useful for adaptation to our purposes. Would it be possible for you to put us in touch with the company responsible for the development of this particular piece of equipment?

H. F. MORLEY,
President,
Park-A-Ramp, Inc.

The hydraulic equipment used on the Lewis-Shepard coil stacker described in the article in question

If You Specify Heat Exchangers...


YOUNG...heat exchanger calculator
Young Quality
1. Set Gals./Minute of fluid used opposite Temperature Difference and note Heat Load above arrow.
2. Set Larger Temp. Diff. under the Smaller Temp. Diff. and note Key No. above arrow.
3. Set Key No. (from Step 2) under the Larger Temp. Diff. minus the Smaller Temp. Diff. Note Log M.T.D. above arrow.
4. Compute "K" and "R". Set "K" under arrow and read Correction Factor "F" under "R". Multiply Log M.T.D. (from Step 3) by Correction Factor "F" to get True L.M.T.D.
9. Set True L.M.T.D. under "U" value (Step 8). Read Area (Sq. Ft.) above Heat Load (Step 1).

...You can use this

NEW YOUNG HEAT EXCHANGER CALCULATOR

AN EASY WAY TO SELECT THE CORRECT UNIT FOR YOUR JOB

Single pass, fixed tube bundle, 74 stock models

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This exclusive Young Heat Exchanger Calculator is an engineering tool specially designed to help you calculate and specify Young shell and tube Heat Exchangers. Designed to save you time, the Calculator enables an engineer to determine quickly individual heat transfer coefficients for the shell side and tube side, and by combining them with suitable fouling factors to determine over-all heat transfer coefficients. It also gives you a visual picture how the size of a Heat Exchanger will vary with fluid temperatures and velocities.

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Transmission Engineering Co.
53 Stevenson St., San Francisco, Calif.

COLORADO
Alta Engineering Co.
11650 Montview Blvd.
Aurora, Colo.

ILLINOIS
Norman Engineering Co.
2115 West Marquette Rd.
Chicago, Ill.

MASSACHUSETTS
Pump Equip. & Engineering Co.
79 Prospect St., Somerville, Mass.

MARYLAND
Cauliflower, Inc., Ellicott City, Md.

MICHIGAN
Industrial Air & Hydraulic Equip. Co.
13306 Kercheval Ave., Detroit, Mich.

Harold J. Young
206 Montgomery Bldg.
920 Second St., Muskegon, Mich.

MISSOURI
Allied Transmission Equip. Co.
1733 Main St., Kansas City, Mo.

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St. Louis, Mo.

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Charleston, S. C.

TENNESSEE
Southern Company, Inc.
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Memphis, Tenn.

TEXAS
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1501 South Akard St., Dallas, Tex.

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MODEL S-404 *Air Operated Hydraulic Test Unit. Fully equipped with all necessary instruments, controls and connecting hoses. Ready for immediate operation.*

PORTABLE HYDRAULIC POWER UNIT

For Simplified Testing of Aircraft Hydraulic Components and Systems

USES—Model S-404 is designed for simplified testing at high pressures—500 to 5000 PSI—and at low flows—approximately 1 GPM at 2000 PSI. Use it for (1) Static testing of complete airplane systems. (2) Operation of subassemblies in which hydraulics are installed before final assembly such as wings, nose assemblies, etc. (3) Operation of simple systems during service such as flaps, wing folding, cowl flaps, doors. (4) Testing of relief valve settings. (5) Proof-testing hose assemblies. (6) Testing of hydraulic cylinders. (7) Operating power brakes and many other uses.

Douglas, Lockheed, Martin and other major aircraft companies are ordering this versatile, low-cost, test unit by the dozens. Portability permits tests at any point reached by plant air supply lines. Speeds work—saves tieing up expensive test equipment for simple test jobs. Write for Engineering Bulletin No. 400 which gives circuit and complete specifications.

AVAILABLE SEPARATELY—Heart of the Model S-404 and of several other Sprague Test Machines is the Sprague Model S-216-C Air-Operated Hydraulic Boost Pump which is available as a separate unit for custom installations. Measures 8¼" wide x 9½" deep. Simple, reliable, inexpensive. Thousands in use.

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Letters to the Editor

Continued

is standard with a number of manufacturers. We believe that you can get assistance in your problems from the following companies: The Battersby Company, 3701 North Broad St., Philadelphia 40, Pa., and Colliflower, Inc., Baltimore National Pike, Ellicott City, Maryland. Both of these companies have staffs of very capable hydraulic engineers who will assist you in the selection and design of proper equipment.

Basic Pneumatics

Our industrial training department would appreciate your advice as to when your booklet containing the series of articles "A Beginners' Course in Basic Pneumatics" will be ready for distribution.

JOSEPH W. OZAG,
Instructor, W. E. Co.

The booklet in which the entire series of articles on the Beginners' Course in Basic Pneumatics will be reprinted will be published just as soon as possible after the series has been completed. We will announce in APPLIED HYDRAULICS when the booklet will be ready for distribution.

Valve for Double Acting Cylinders

I wonder if you would know of a hydraulic valve similar to the Logan Air Valve Model No. 50 or the Hannifin Duplex Model No. D37, which will operate two double acting cylinders using a single valve with one handle.

JAMES F. VAN ZANDT,
Chief Engineer,
Monocouple Aircraft Corporation

As far as we know there is no hydraulic valve comparable to the Logan Air Valve Model 50 which will permit you to operate two double acting cylinders from one small valve. This valve would be a nice solution to a space problem, but being a plug design, it will not work for pressures over 150 psi. Could you use a bank or a multiple

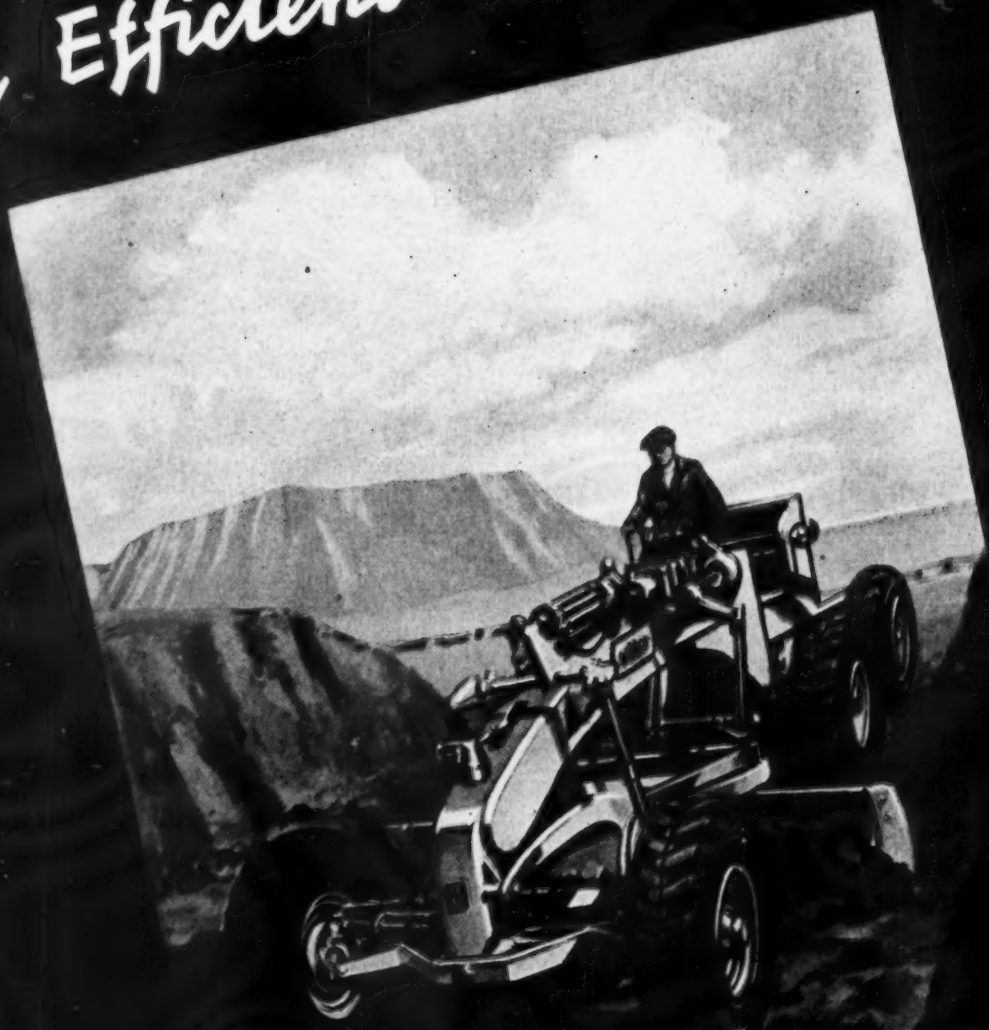
Continued on page 21

Circle 105 on Reader Service Card

Circle 60 on Reader Service Card

Fo

For Efficient Power Transmission



The "CARLISLE" GRADER
KEELAVITE HYDRAULICS GIVE EFFICIENT TROUBLE-FREE CONTROL
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Keelavite hydraulics

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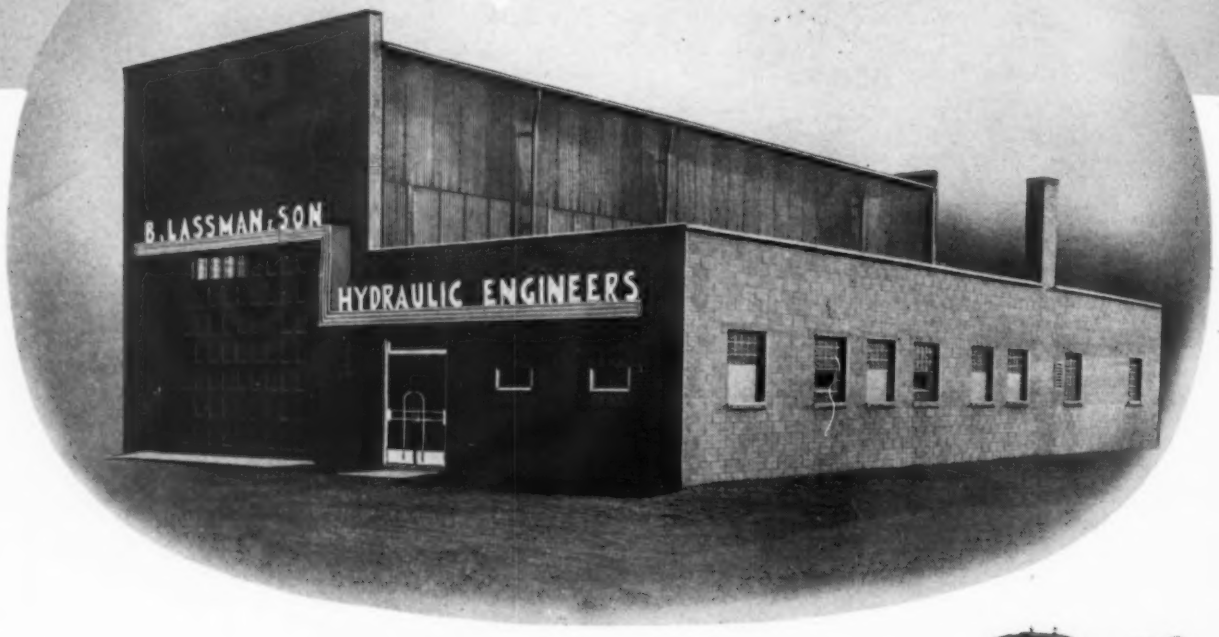
Sales Representatives for Canada, Genaire Limited, P.O. Box 84, Municipal Airport, St. Catherines, Ontario.

A New, Modern Plant Dedicated to Traditions in Hydraulic Engineering That Were Established 30 Years Ago



Recently completed Plant and Offices of Benjamin Lassman & Son, located in suburban Pittsburgh, Route 8, Glenshaw, Pa.

300-Ton Manually Controlled Hydraulic Straightening Press... including Valves, Pumps, Controls . . . completely engineered and built by Benjamin Lassman & Son.

Benjamin Lassman & Son

1. Builders of Special Purpose Industrial Hydraulic Machinery.
2. Hydraulic Pumping Units with Manual, Semi-Automatic or Full Automatic Controls.
3. Complete Hydraulic Systems.
4. Hydraulic Valves.

Our new Plant is equipped to build exactingly, according to specifications. When your requirements include Hydraulic Equipment which must be designed and built for special purposes, we welcome your call or visit.

Representatives in Principal Areas

BENJAMIN LASSMAN & SON

ENGINEERS & MANUFACTURERS SINCE 1921

ROUTE 8, GLENSHAW (Suburban Pittsburgh), PA.

HIGH PRESSURE HYDRAULIC EQUIPMENT . . . APPLICATION & DESIGN.

Letters to the Editor

Continued

valve? We might be able to make additional suggestions if you would supply more of your circuit requirements.

Rotary Transmissions

We would like to know the names of any manufacturers producing the type of rotary hydraulic transmissions described in your November, 1951 issue, page 68.

DAVID GIVEN,
Sterling Engineering Co.

We published a list of manufacturers of rotary hydraulic transmissions on page 178 of the January 1953 Directory issue. A tear sheet is enclosed.

Hydraulic Tank Design

In one of your 1952 issues, you published an article on the construction of a hydraulic tank and the baffle arrangement inside the tank. Would it be possible for you to send us this information.

GEORGE VARGO,
Assistant Plant Engineer,
Lincoln-Mercury Div.
Ford Motor Company

The design in question appeared in the article "How to Design Hydraulic Reservoirs" by W. T. McCormick and appeared in the May, 1952 issue of APPLIED HYDRAULICS. We are pleased to send you a set of tear sheets of this article.

J.I.C. Standards

Could you tell us where we could get copies of the J. I. C. Hydraulic and Pneumatic Standards? We are designing a new cylinder and would like to build it around these Standards.

R. C. MCKEE,
Robert C. McKee Co.

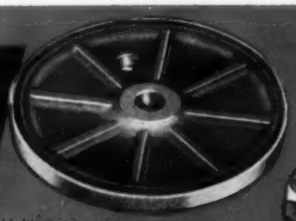
Copies of the J. I. C. Hydraulic and J. I. C. Pneumatic Standards for Industrial Equipment may be obtained from Joint Industry Committee, P. O. Box 182, North End Station, Detroit 2, Mich. The new revised Standards (Hydraulics) will be ready about May 1.

DOUBLE MACHINE LIFE
THROUGH POSITIVE FILTRATION OF HYDRAULIC-LUBRICATING OILS

GENERAL AF-500 *Industrial* FILTERS

GENERAL AF-500 FILTERS are designed to do just one thing—provide low-cost, day-by-day protection of hydraulic and lubricating oils used in quality machine tools. The AF-500's highly absorbent ALL-WOOL felt cartridge safely traps solids and moisture before they can damage vital machine parts. Costly oils and other industrial liquids are thus kept completely clean, assuring better performance, longer machine life, and low maintenance.

DISASSEMBLES IN SECONDS!



Cleanable wool felt cartridge quickly removed simply by unscrewing center bolt and lifting off cover and washers.

AF-500 for New or Old Equipment

- Positive absorbing action removes particles as fine as 5 microns. Safely filters lubricating and hydraulic oils, paints, lacquers, and other heavy liquids.
- Eliminates harmful condensation moisture, eliminates formation of sludge and rust.
- Finest all-wool felt cartridge easily cleanable in a few minutes in any suitable solvent. Single-bolt assembly allows quick removal of cartridge from filter—without disturbing piping.
- 15-20 gallons per minute capacity depending upon liquid viscosity.
- Simple installation plan. Allows inlet to be turned to top or bottom —whichever gives the best space and piping accommodations.
- Equally adaptable as original or replacement equipment—on new or old machines.

REMEMBER—We'll gladly advise you without obligation on any filtering problems.

GENERAL FILTERS, INC.
12890 WESTWOOD • DETROIT 23, MICHIGAN
CANADIAN GENERAL FILTERS, LTD.
2679 DANFORTH AVENUE • TORONTO 13, ONTARIO

OTTAWA STEEL PRODUCTS, INC.

Redesigned All *Hydraulic* Equipment to Incorporate

MARVEL Synclinal FILTERS

"After several months use we have checked the hydraulic systems of our machines and although they have worked in extremely dirty conditions, the hydraulic oil is clean."

Harvey A. Martin
Purchasing Agent

SUMP TYPE
(Cutaway)

Marvel Filters have scored again. Another Original Equipment Manufacturer added to the over 350 that are now specifying Marvel Synclinal Filters to protect hydraulic and low pressure systems.

Marvel Filters are available in sump and line type models, in capacities of 5 to 100 G.P.M., and in wire mesh sizes from 30 to 200. Both types may be easily disassembled, cleaned and reassembled in a few minutes' time by any workman. This reduces "down-time" to a minimum. Line types operate in any position and may be serviced without disturbing pipe fittings.

WATER FILTERS—Both our sump and line types have been designed for use in all water filtering applications with no change in the basic Synclinal design.

MARVEL *Engineering Company*

625E-3 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS

Write for Complete Engineering Data — Specify Oil or Water

Meets J. I. C. Standards

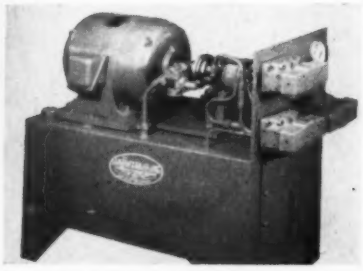
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

FLOW CONTROL VALVE
. . . for operating pressures to 3000 psi

Sizes: ¼, ⅜ and ¾ inch sizes for subplate mounting, offered in 2-port and 3-port types.
Design: Featuring a 2-way adjustable orifice, it provides 100 percent regulation of flow within a given range, and a choice of ranges to accommodate low or high volume systems. In addition to being adjustable in length, the width of the orifice can also be varied by turning the entire control stem upward or downward. A knurled dial adjustment locking screw limits each range of control. To change the range the screw is turned outward, releasing the spool.
Application: For metering or controlling the oil flow in hydraulic systems.

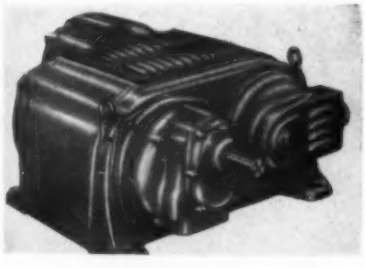
Denison Engineering Company
Columbus, Ohio
Circle 151 on Reader Service Card



HYDRAULIC UNIT
. . . gives complete power source

Design: Consists of a 12 gpm hydraulic pump and a 7½ hp motor. The rest of the equipment includes a relief valve and three panel mounted, solenoid operated, four-way control valves. The tank holds fifty gallons, is equipped with a filter, breather, oil level gage and baffles.
Applications: This package unit can be used on press installations and special machinery.

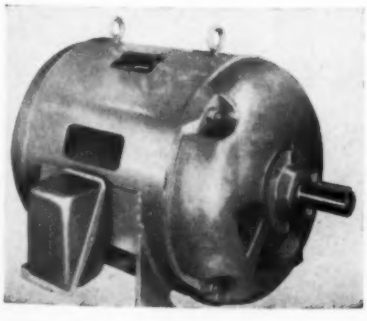
J. N. Fauver Co.
Detroit, Michigan
Circle 152 on Reader Service Card



VARIDRIVE MOTORS
. . . new series to 30 hp

Sizes: From ¼ to 50 hp with speed variations up to 10:1. Speeds from 2 to 10,000 rpm.
Design: All-in-one construction (motor, variable speed transmission and gearing when necessary), microspeed control and indicator, splined Varidisc sheaves, double cog varibelts with autotaut tension control for permanent belt adjustment, dual belt construction, asbestos protected motor in normalized

U.S. Electrical Motors, Inc.
Los Angeles, California
Circle 153 on Reader Service Card



ELECTRIC MOTOR FRAMES
. . . modernized for high power ratings

Designation: T-type
Sizes: From frame size 444 to 586
Features: The entire T-type line, which runs as high as 250 horsepower, will have the new frames. The higher ratings will offer the advantages of rolled steel frames and cast iron end bells, assuring permanent alignment. Bearing caps at the shaft ends, leading to longer bearing life, will be another advantage of the new design.

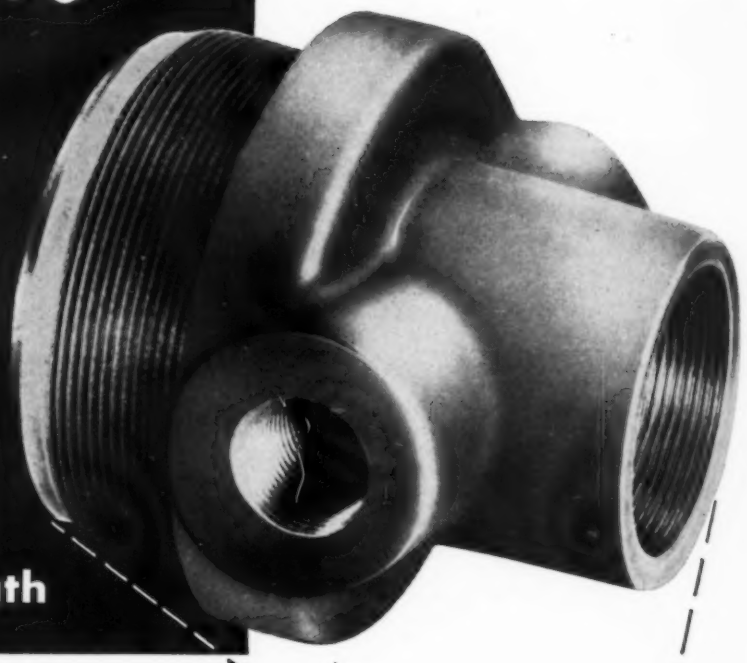
Electro Dynamic Division
General Dynamics Corporation
Bayonne, New Jersey
Circle 154 on Reader Service Card

Pathon

HYDRAULIC CYLINDER

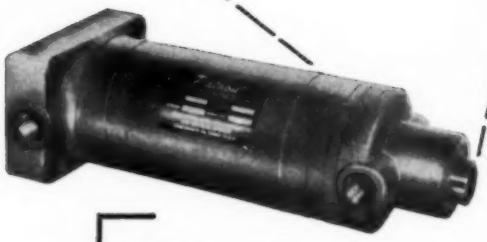
RH Series 2000 P. S. I.

heads are retained by a single screw thread for maximum strength



You get

- Low stress concentration
- Greater resistance to fatigue and shock loading
- Rotatable pipe ports and mounting pads
- Compactness difficult to obtain in any other type of construction



In choosing Hydraulic Cylinders what are you looking for? *Compactness? Adaptability? Greater efficiency in operation?* You're sure of all three when you specify Pathon Series RH 2000 P.S.I. Hydraulic Cylinders.
Write us today for our catalog. Let us show you why Pathon is rapidly becoming the leader in its field.

Pathon

AIR CYLINDERS

HYDRAULIC DIRECTIONAL CONTROL VALVES

DO A BETTER JOB FOR YOU

Pathon MANUFACTURING CO.

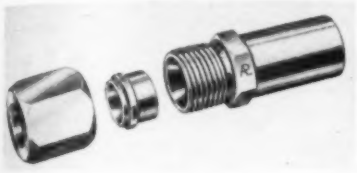
3823 Pacific Avenue Cincinnati 12, Ohio

NEW PRODUCTS

Continued

TUBE REDUCER
. . . increases size combination range

Designation: Ferulok Flareless Bite Type.
Sizes: From ¼ through 1 inch outside diameter tubing.



Operation: Reducer is inserted into the tube connection end of the regular fitting and attached with the nut and ferrule of that fitting. The other end of the reducer is coupled to the smaller size tubing with the reducers nut and ferrule.
Application: Used to convert any Ferulok fitting into a combination size unit permitting connection of a smaller size tube as is often necessary in certain tubing system installations.

The Parker Appliance Company
Cleveland, Ohio
Circle 155 on Reader Service Card

DOUBLE PUMPS
. . . for mobile applications

Designation: Series V-2200 and V-3200
Sizes: Ten sizes of series V-2200 pumps are available, with any combination of 2, 5, 8 or 11 gpm delivery units. Series V-3200

pumps are made in sixteen sizes with a choice of a 2, 5, 8 or 11 gpm at the small end and a 12, 15, 18 or 24 gpm pump at the other.
Design: Both series are compact and each consists of two vane

The Electrol Check Valve
Prevents Reversal of Flow
in { Air . . . Oil or Water Applications

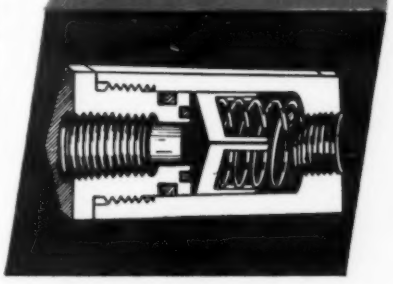


Diagram showing internal construction of the Electrol (463FP) Check Valve.

The Electrol (463FP) Check Valve is ideally suited for heavy-duty service applications — providing positive sealing against return flow in air . . . oil . . . or water control lines, with a minimum of pressure drop. It has a maximum operating pressure of 5000 P. S. I., with a cracking pressure — in free flow direction — from 2 to 8 P. S. I. Elements are of brass and bronze —and include a patented O-ring check seat. Write today for complete engineering data.

Better Designed Products Use Electrol Hydraulics

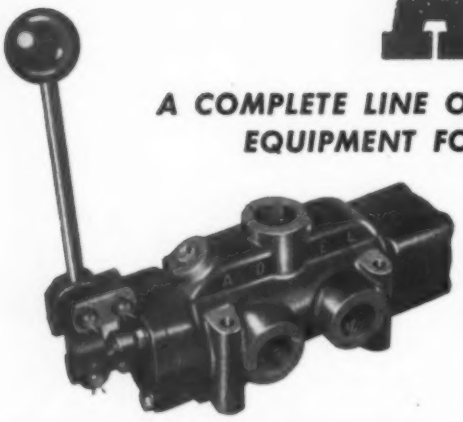
Electrol INCORPORATED
HYDRAULICS
KINGSTON, NEW YORK

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

Circle 32 on Reader Service Card

ADEL

A COMPLETE LINE OF INDUSTRIAL HYDRAULIC EQUIPMENT FOR EVERY APPLICATION



For fourteen years ADEL has continuously directed its energies to the advanced development and production of high-quality hydraulic equipment. With the most modern facilities in our 150,000 square foot plant, we build ruggedness, efficiency and compactness into each ADEL unit. The variety of equipment being manufactured has been steadily expanded until today it encompasses a complete line of hydraulic control valves, power pumps, solenoid operated remote controls and related equipment. ADEL can supply you with all the elements necessary to build complete hydraulic systems meeting the most exacting requirements. Make comparisons and see why more and more users, year after year, specify ADEL industrial hydraulic equipment.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

Write for Bulletins
ADEL DIVISION
OF GENERAL METALS
CORPORATION,
10771 Van Owen St.,
Burbank, California

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION · Burbank, Calif.

Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR & HYDRAULIC CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SÖDERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH. • HYDRAQUIP CORPORATION, HOUSTON, TEX.

NEW PRODUCTS

Continued

type pumps in a single housing, driven by a common shaft. This provides the required independent systems and in addition significant savings in space. Their basic design is identical with Vickers standard line of mobile pumps, with balanced pressure design and automatic adjustment of both radial and axial clearances. A choice of splined, threaded or straight keyed shaft and face, flange and foot mountings are available.

Applications: For mobile uses where two independent hydraulic power sources are required such as material handling equipment, road and construction machinery.

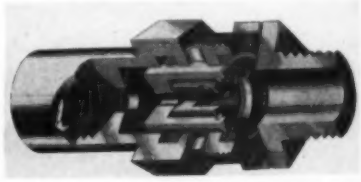
Vickers Incorporated
Detroit, Michigan

Circle 156 on Reader Service Card

QUICK RELEASE VALVE
. . . provides chatterproof service

Size: 2 1/16 inches overall length, 1½ ounces weight.

Design: Light weight and compactness which permit its use on rotating elements without disturbing dynamic balance; a built-in orifice which prevents



accidental removal of orifice from the line and eliminates possibility of pressure equalization responsible for chatter; double-piston design for smooth, positive quick-releasing action; and distinctive construction eliminates the need for a spring.

Application: To handle air pressure from 0 to 250 psi on pneumatic clutches up to 1500 hp.

Deublin Company
Glenview, Illinois

Circle 157 on Reader Service Card

For more New Product data turn to page 120

for jobs where you "can't take chances"...

SNAP-LOCK
TRADE MARK

again proved dependable for controlling repetitive cycles at 60 passes per minute

This Zagar acoustical wall tile drilling machine employs 5 Snap-Lock limit switches—three automatically controlling movements of the 96 spindle drill head and two actuating the hydraulic system operating the work table.

Zagar Tool Inc., Cleveland, O., manufactures drill heads, drilling and broaching machines. After 10 years experience with Namco Snap-Lock limit switches applied to a wide variety of large and small machine tools, Mr. Frank Zagar, General Manager states—

> **"for the fast, exacting and dependable controls in our machines, we can take no chances—we recommend Snap-Locks to customers all over the country"**

This confidence is typical of expressions from machine tool builders, 90% of whom have adopted Snap-Locks as standard built-in equipment—some using more than 200 units on a single installation.

You can depend on Snap-Lock—Ask your Engineers to contact ours. Specifications Bulletin EM-51.

HEAVY DUTY FEATURES OF SNAP-LOCK LIMIT SWITCHES

built BY machine tool builders FOR machine tool builders

- Separate safety walled enclosures for electrical and mechanical sides.
- Hardened steel parts, rugged, compact.
- Heavy insulation, oil and dust resistant case.
- Positive lock in "on" and "off" positions.
- Single pole, normally open and closed, double break contact arrangements.
- Self wiping coin silver contacts.
- Wide variety of standard mountings and operating levers.

ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME COMPANY

186 EAST 131 STREET, CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

repairmen go airborne . . . with HYDRECO Oil Power

Full Hydraulic Ladder made by J. H. Holan Corporation, Cleveland, manufacturer of automotive equipment for public utilities, uses HYDRECO pump, valves and cylinder. Ladder has unlimited swing, infinite number of elevations, adjustable platform.

HYDRECO Oil Power puts trouble-shooters in the air with ease and safety on this new full hydraulic ladder. The repairman can spot the ladder accurately, move it in any direction by a simple three-lever control unit.

The ladder is equipped with HYDRECO pump, valves and cylinder for top speed and efficiency, easy operation, trouble-free performance, and absolute safety.

HYDRECO Oil Power features include:

1. Hollow plunger control valve to eliminate dead spots that create shock pressure peaks and load the pump.
2. Check valve (built into control valve) to prevent load drops while pressure port is opening.
3. Rugged Four-Bolt Design Pump to provide dependable flow of power.

Special HYDRECO Oil Power equipment can improve the performance and efficiency of your product. Applications range from ½ to 150 gpm and up to 1500 psi. Let HYDRECO assist you with your special hydraulic problems. Send for bulletin on pumps, valves and cylinders.

HYDRECO A DIVISION OF THE NEW YORK AIR BRAKE CO.

1104 EAST 222nd STREET • CLEVELAND 17, OHIO

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

PRESSURE PLUGS, which seal tight without compound are outlined in literature offered by Standard Pressed Steel Co. These plugs have Dryseal threads.
Circle 107 on Reader Service Card

CYLINDER FINISH STEEL TUBING for hydraulic cylinders, which eliminates boring and honing, and can be cut to length, is discussed in Bulletin R-7, published by Tube Reducing Corporation.
Circle 118 on Reader Service Card

VARIABLE SPEED DRIVES are featured in new bulletin, released by U. S. Electrical Motors, Inc. The catalog gives factual proof of increased production attainable with Varidrive motors.
Circle 121 on Reader Service Card

3 and 4-WAY DIRECTIONAL VALVES manufactured by Valvair Corporation are outlined in Bulletin KA-5. Dimensional, application and design details of these air valves are supplied.
Circle 125 on Reader Service Card

SOLENOID VALVE WITH FLOATING SHEAR SEAL, a new principle which brings the solenoid valve to its highest degree of performance, is detailed in a booklet offered by Valcor Corporation.
Circle 124 on Reader Service Card

ADJUSTABLE FLOW REGULATOR is discussed in illustrated Circular A issued by Waterman Engineering Company. Used in hydraulic circuits, the valve accurately controls speed of cylinder travel.
Circle 127 on Reader Service Card

TUBE FITTINGS, pipe fittings and accessories are detailed in a new catalog, No. 553 published by Flodar Corporation. Catalog includes engineering data, installation instructions and tubing recommendations.
Circle 35 on Reader Service Card

Continued on page 31

ANCHOR

DUCTILE-SLEEVE, TWO-WIRE BRAID HOSE ASSEMBLIES

for extra safety in high-pressure usage

Factory assembled to your specifications — you get just what you want — plus an extra margin of safety and dependability.

Exclusive, ductile-sleeve, swaged-on grip makes coupling virtually part of hose reinforcing wire — prevents blow-offs.

No leaks — positive seal eliminates leakage even under extreme pressures.

Cuts assembly costs — neat, compact design makes installation fast and easy — gives you a better-looking job.

Get all the details. Attach coupon to your letterhead and mail today.

NEW!
REVOLUTIONARY
ANCHOR FLANCO
SPLIT-FLANGE CLAMP
Positive leakproof connection without threaded joints. Bolt centers are located to distribute the forces evenly and prevent tilting of the clamp halves. Easy to assemble with small automotive-type wrench.

D-16

ANCHOR COUPLING CO. INC.

Main Office and Factory: LIBERTYVILLE, ILLINOIS

FACTORY BRANCHES: DETROIT, MICHIGAN • DALLAS, TEXAS

Anchor Coupling Co. Inc.
Dept. AH53, Libertyville, Illinois

I'd like to know more about

- ☐ Anchor Ductile-Sleeve Hose Assemblies
- ☐ New Anchor Flanco Split-flange clamp-type coupling

Send me more information.

Name..... Title.....

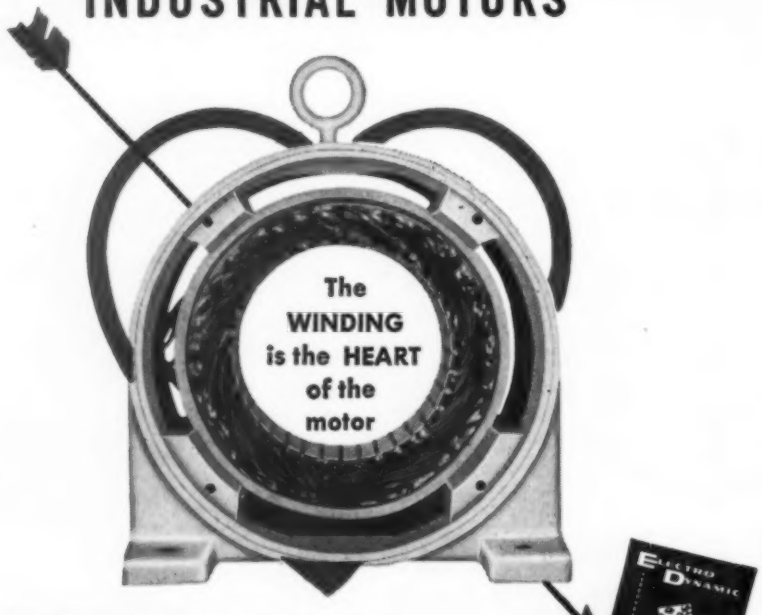
Company Name.....

Company Address.....

City..... (.....) State.....

ELECTRO *xtra* DYNAMIC *ependable*

INDUSTRIAL MOTORS



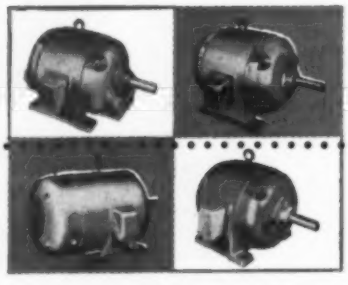
Every Electro Dynamic motor is built with

EXTRA INSULATION in stator slots and between phases
EXTRA IMPREGNATIONS and bakings of the wound stator
EXTRA HIGH-FREQUENCY TESTING of insulation between turns

WRITE TODAY FOR CATALOGUE No. 580

From 1 to 250 Horsepower (N. E. M. A. STANDARDS)

One-piece cast iron frames.



Extra large "free-flo" air channels.

Permanently aligned cast iron brackets.

Liberal size grease lubricated bearings.

Also a complete line of Direct Current motors and generators

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY

Circle 30 on Reader Service Card

Free Literature Offered in this Month's Ads

Continued

PRESSURE SWITCHES, operating in any position, are outlined in catalog 2M-S, offered by Barksdale Valves. These switches will operate in 3000 psi systems.
Circle 12 on Reader Service Card

AIR-FILTER and aftercooler manufactured by R. P. Adams, Inc. have their advantages and applications outlined in Bulletin 176.
Circle 2 on Reader Service Card

BRONZE PARTS of highest quality are described in literature available from The American Crucible Products Co.
Circle 8 on Reader Service Card

MANIFOLDS for hydraulic equipment control systems, which reduce piping, are the subject of a new brochure prepared by Almo Tool Co.
Circle 7 on Reader Service Card

REGULATOR-FILTER-LUBRICATOR, all in one unit, has been detailed in a catalog prepared by CCA Products Division, Breco Manufacturing Co.
Circle 19 on Reader Service Card

HYDRAULIC POWER UNITS, engineered and designed for specific job requirements are illustrated in a catalog available from The Cardwell Machine Co.
Circle 18 on Reader Service Card

OIL-FILTER which features resin impregnated fibre cartridge is the subject of a bulletin offered by Cuno Engineering Corporation.
Circle 23 on Reader Service Card

PUMP/MOTOR, which has been designed for both jobs, ready for use as either pump or motor without adjustments is featured in Pump/Motor Bulletin P-5 available from The Denison Engineering Co.
Circle 26 on Reader Service Card

PUMPCUPS for all hydraulic and air controls are detailed in a bulletin published by Darling Valve and Manufacturing Co.
Circle 25 on Reader Service Card

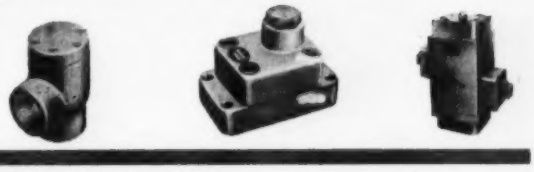
Continued on page 32

DOUBLE A HYDRAULIC CONTROL VALVES

A Complete Line for every application

Sizes: 1/4" I.P.S. thru 2" I.P.S. Pressures: up to 5000 psi

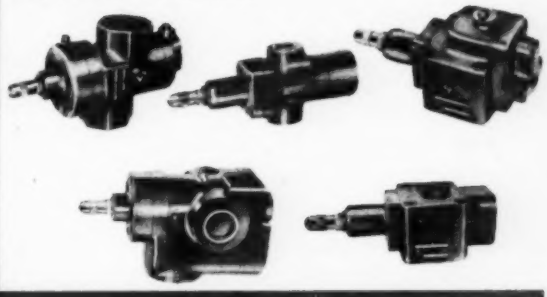
CHECK VALVES



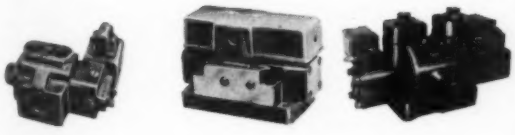
RELIEF VALVES

FLOW CONTROL VALVES

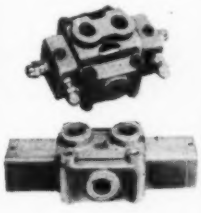
BY-PASS VALVES . . . REDUCING VALVES



SOLENOID CONTROLLED PILOT OPERATED VALVES

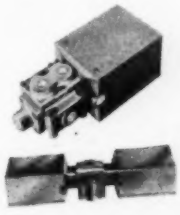


PILOT OPERATED VALVES

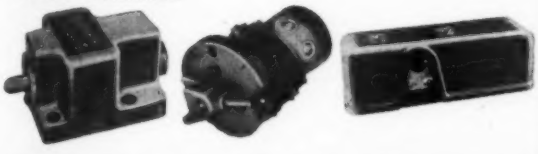


CAM OPERATED VALVES

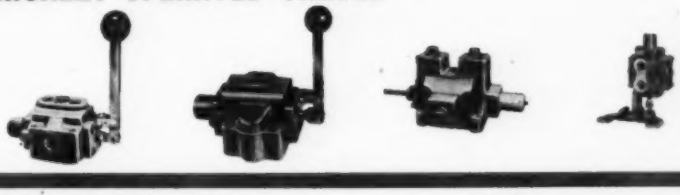
DIRECT SOLENOID VALVES



PILOT VALVES



MANUALLY OPERATED VALVES



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Oakland — Los Angeles
Olympic 3-5521 — Kimball 8271

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Toronto—Waverly 4417

GEORGIA
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MASSACHUSETTS
Compressed Air Products Co.
Amherst—1320

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Ellicott City—871

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Tannate®
LEATHER PACKINGS

Job Engineered from Start to Finish

Just as a machine or tool designer starts building toward an objective—so do Rhoads engineers start to "custom-manufacture" Tannate Leather Packings. They are not ordinary packings—no sir! Like a custom-designed hydraulic press, Tannate leather packings are job-engineered from start to finish—*specially tanned, die-formed and "custom-impregnated" to accomplish definite objectives.* Detailed accuracy of finish is another "custom-line" feature in Tannate packings.

You get these advantages in Tannate Leather Packings: They have a low coefficient of friction; do not cold flow; will not score or abrade. They do not require lubrication, and they can be stored indefinitely without loss of tensile strength. Tannate packings are "custom-manufactured" to operate efficiently over a wide range of pressures and temperatures—from sub-zero to over 200° F.—and with different types of mediums.

Send us your packing requirements for quotation. Include type, service, pressure, temperature, dimensions and quantity. There's no obligation. Do it today.

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Send for the Rhoads Packing Data File. No obligation.

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INDUSTRIAL LEATHERS

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Free Literature Offered in this Month's Ads

Continued

RELIEF VALVE, to maintain specific pre-determined pressures on machine tool hydraulic mechanisms is featured in a mechanical data book published by The Fulflo Specialties Co. Inc.

Circle 38 on Reader Service Card

BALL VALVE which is applicable for liquids, gas or steam, is detailed in a folder available from the Foxboro Company. This 1/4 inch shut off valve, handling pressures up to 3000 psi is leakproof.

Circle 37 on Reader Service Card

O-RINGS which stand up against high static pressures, heat, friction, shock, etc. are outlined in a catalog offered by Goshen Rubber Company, Inc.

Circle 43 on Reader Service Card

OIL PURIFIER which removes solid abrasive contamination and keeps oil clean and safe to use indefinitely, is described in Hydraulic Bulletin offered by Honan Crane Corporation. It features profitable use of the purifier in many hydraulic applications.

Circle 53 on Reader Service Card

SPECIAL AIR AND HYDRAULIC CYLINDERS are discussed in Bulletin 350, published by Hydro-Line Mfg. Co.

Circle 58 on Reader Service Card

TRIPLEX PUMPS, their features and advantages are outlined in a Bulletin available from Kobe Inc. Standard units develop up to 5000 psi; special units up to 20,000 psi.

Circle 63 on Reader Service Card

VARIABLE SPEED PULLEY AND TRANSMISSION is the title of an illustrated catalog, containing complete technical data on these units, offered by Lovejoy Flexible Coupling Co.

Circle 70 on Reader Service Card

Continued on page 52

new cylinder tubing

eliminates boring and honing

You can realize startling cost savings when you use Rockrite® cylinder finish steel tubing for hydraulic cylinders, shock absorbers and similar parts. ● The inside is smooth, scratch-free — a surface just right for a piston with soft packing. Smooth bore surface plus exceptionally close dimensional tolerances means that this tubing can be cut-to-length and used as is. It is easy to make standard parts that are interchangeable. Slash your costs by using Rockrite cylinder finish tubing. ● Ask for Bulletin R-7 giving more data.

ROCKRITE TUBING

TUBE REDUCING CORPORATION

WALLINGTON, NEW JERSEY

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

ROLLER CHAINS AND SPROCKETS . . . Baldwin-Duckworth Division of Chain Belt Company has issued a new catalog 52-1, covering roller chains and sprockets. The 54-page book describes and illustrates the advantages of chains. One section outlines how to select standard chains, showing formulas, tables of dimensions, strengths and weights, and examples illustrating this procedure. Stock sprockets and their characteristics are detailed; bore, keyway and setscrew information presented. Proper maintenance of chain drives is reviewed and information on chain vises, flexible couplings and coupling covers is also provided.

Circle 201 on Reader Service Card

STEEL HYDRAULIC TUBING . . . "You can make a better product with steel hydraulic tubing" is the title of a booklet prepared by Summerill Tubing Company Division of Columbia Steel and Shafting Company. Eight pages in length, the booklet discusses tubing requirements and specifications for hydraulic applications. The advantages of steel seamless tubing and specific data on common working pressures of available sizes. The booklet also lists a broad line of mechanical, diesel, pressure and specialty tubing.

Circle 202 on Reader Service Card

TEFLON PRODUCTS . . . An 8 page illustrated booklet issued by Raybestos-Manhatten, Inc. describes braided and plastic packings for stuffing boxes, valve stems, gaskets, rings in irregular shapes and other products made of Teflon.

Circle 203 on Reader Service Card

HYDRAULIC VALVES . . . A new 44 page valve catalog, No. 352A, has been issued by Republic Manufacturing Co. Listed are needle, globe, plug check, relief and special valves. To this edition have been added gage protectors and snubbers, bleeders and AN vacuum control valves. Units listed are made of various metals, including brass, bronze, steel, stainless steel and aluminum alloy, and are suitable for hydraulic systems, aircraft instrumentation and industrial applications. The bulletin shows construction details and includes complete dimensions and specifications.

Circle 204 on Reader Service Card

HYDRAULIC CYLINDERS . . . A new line of space-saving high-pressure hydraulic cylinders is shown in an attractive catalog issued by The S-P Manufacturing Company. The catalog states that the cylinders are newly engineered throughout in compliance with J. I. C. standards. Construction is all steel, employing rolled steel for end plates and mountings, and the cylinders are designed for working pressures up to 2000 psi. The ten-page illustrated catalog shows eleven different models in the line, each model being available in eleven bore sizes from 1½ to 8 inches, giving a wide range of selection for a particular application. One of the cylinder's features is a bronze quick-change packing cartridge, which can be taken out instantly by removing a snap ring for servicing the packing. A dimensional drawing next to the picture of each model refers to a common table of dimensions. This time-saving table folds out so that it is adjacent to any page being used. The catalog also includes extensive pressure and flow data organized into usable tabular form.

Circle 205 on Reader Service Card

MOLDED RUBBER PARTS . . . An 8 page 2 color bulletin issued by the Tyre Rubber Company describes the various types of molded and extruded rubber parts manufactured by the Industrial Division. Individual sections deal with standard items of all kinds, molded parts for the aeronautical, agricultural, automotive, electronic and other industries. Several parts are illustrated and described in detail. Two charts are included, one shows a key to rubber and synthetic compounds for automotive and aeronautical applications, the other show the relative properties of natural and synthetic rubbers.

Circle 206 on Reader Service Card

Circle 29 on Reader Service Card →

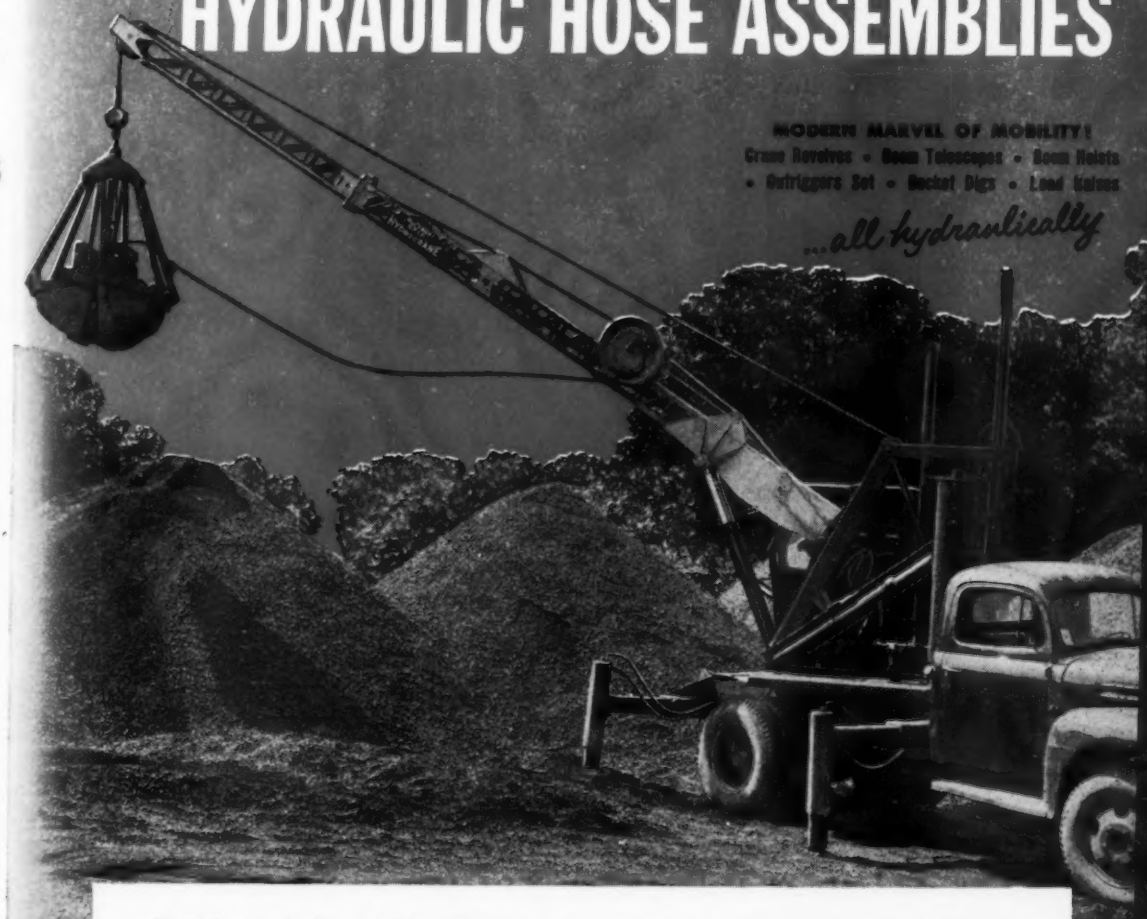
SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

6 HYDRAULIC MOVEMENTS OF BUCYRUS-ERIE HYDROCRANE RECEIVE POSITIVE POWER THROUGH . . .

Eastman

first in the field

HYDRAULIC HOSE ASSEMBLIES

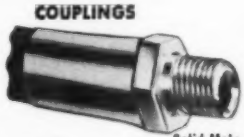

MODERN MARVEL OF MOBILITY!
Crane Revolves • Boom Telescopes • Boom Hoists
• Outriggers Set • Bucket Digs • Load Raises
. . . all hydraulically

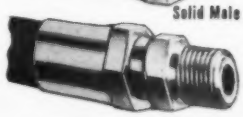
specify **Eastman** *first in the field*

HYDRAULIC HOSE ASSEMBLIES

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

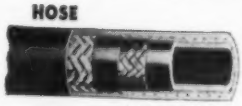
COUPLINGS

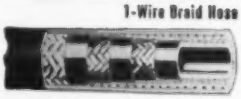

Solid Male

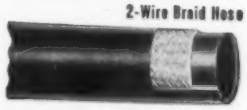

Swivel Male

Swivel Female

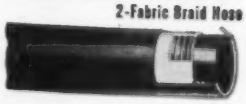
HOSE


1-Wire Braid Hose


2-Wire Braid Hose


1-Fabric Braid Hose

2-Fabric Braid Hose


Spiral Wire Hose

Positive, unfailing hydraulic power is delivered to six basic motions on many Bucyrus-Erie H-3 Hydrocranes through dependable Eastman Hydraulic Hose Assemblies.

Eastman, *first in the field* of Hydraulic Hose Assemblies, pioneered in many original applications of mobile hydraulic power. As early as 1926, J. Peter Eastman experimented with wire braided hose.

Continued Eastman developments have made it possible to apply *more* power, over *greater* distances, through *higher* pressures—until today, 6,500 psi are withstood by the Eastman 3-wire braid hose assemblies used on many Bucyrus-Erie H-3 Hydrocranes.

Take advantage of our 25 years of experience in the application of mobile hydraulic power to manufacturer's original equipment. Engineering consultation on special problems is our specialty . . . complete service yours to command.

Write for free catalog 100 on Eastman hose couplings and fittings.

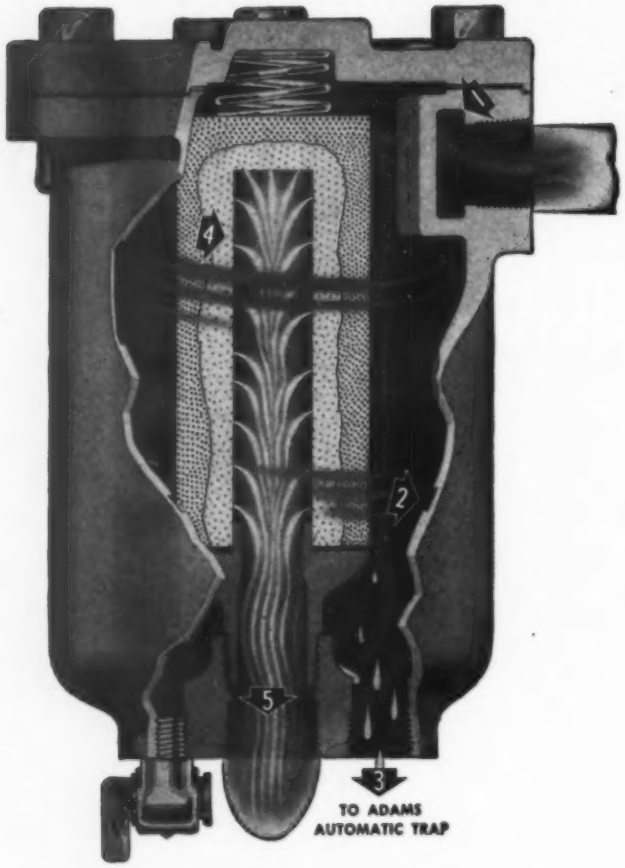
Eastman

MANUFACTURING COMPANY

Since 1914

Dept. AHS, Manitowoc, Wisconsin

ADAMS *has both* *



—— BOTH ANSWERS TO THE PROBLEM OF KEEPING WATER, WATER VAPOR, OIL AND DIRT OUT OF COMPRESSED AIR LINES

There's no *one* answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

* PORO-STONE AIR FILTER

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.

Easily installed in either vertical or horizontal pipe line.

* AFTERCOOLER AND CYCLONE SEPARATOR

Cools air to within a few degrees of cooling water, making certain that compressed air is colder than surrounding atmosphere, so that no further condensation can take place.

Counter flow, air-through-tube design assures continuously high heat transfer rate.

Double cyclonic action deposits all water and entrained oil in moisture chamber.

R. P. ADAMS CO., INC.
249 E. Park Drive, Buffalo 17, New York

Please send me your latest literature, Bulletin No. 176 on BOTH the Poro-Stone air filter and the Adams Aftercooler — Cyclone Separator.

Name.....

Company.....*Title*.....

Address.....

City.....*State*.....

FOR YOUR PROFIT'S SAKE — FIND OUT ABOUT BOTH

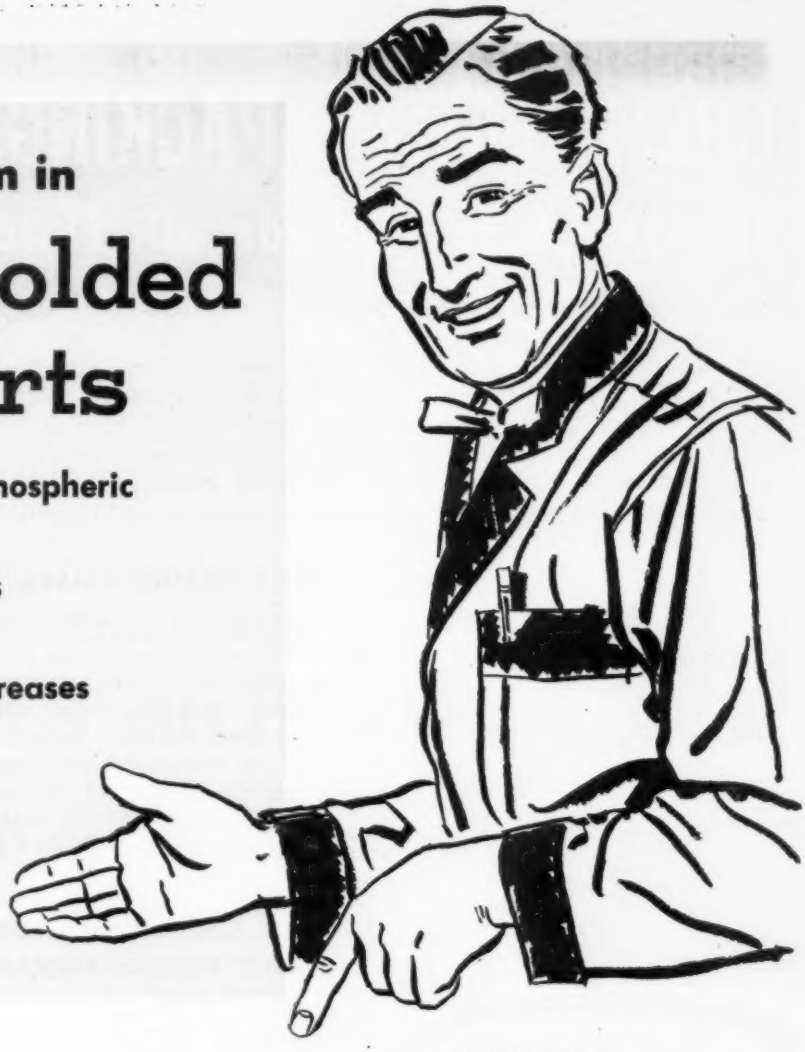
R. P. ADAMS CO., INC., BUFFALO 17, N. Y.

If your problem in

Custom Molded Rubber Parts

- is extreme temperature, or atmospheric conditions
- or is service with special fuels and lubricants
- or is service with acids and greases
- or is exacting tolerance specifications

CALL THE PARKER RUBBER ENGINEER



Meeting your requirements for molded rubber parts is a PARKER specialty. Answering your problems is a challenge to the PARKER Rubber Engineer.

If rubber parts must give long and trouble-free service under very difficult operating conditions, PARKER's research and experience may hold the moneysaving answer for you—as it has for many PARKER customers in automotive, electrical equipment and other industries.

EXCLUSIVE NEW TECHNIQUES—Newly perfected high-production processes and molding methods mean lower cost and greater value in finest custom molded rubber parts. Investigate this PARKER service; mail the coupon today!

FOR EXAMPLE:

This RADAR SCREENER PAD, (approx. 1¾" long), molded from a fuel-resistant compound, presented an intricate molding problem because of the difficulty of removing the part from the mold.

This GRAIN SPACER (approx. 6" in dia.), a typical spacer gasket, which, through perfection of new cost-saving methods and processes, can be produced in large volume in a relatively short time.

This RADAR GROMMET (approx. 1⅞" wide), involving a complicated molding problem, but which, again thanks to newly perfected techniques, is handled to the customer's complete satisfaction from both a time and price standpoint.

Parker

RUBBER PRODUCTS DIVISION

THE PARKER APPLIANCE COMPANY
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PARKER Rubber Products Division
The PARKER Appliance Company
17325 Euclid Avenue, Cleveland 12, Ohio

☐ Please send information on Custom Molded Rubber Parts.
☐ Please have PARKER Rubber Engineer call on me.

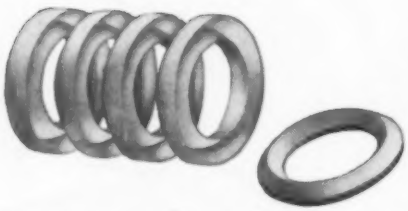
INDIVIDUAL_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

CHEMISEAL MADE OF TEFLON *duPont Trademark PACKINGS

Impervious to All Hydraulic Fluids

Chemiseal Packings—made of duPont Teflon—have zero swelling in all hydrocarbons and newer synthetic hydraulic fluids or solvents. Service temperatures range from −110° F to +500° F. They are unsurpassed in anti-friction properties. Waterproof, non-flammable. Long wearing. Chemical inspections can be eliminated as they are non-corrosive.

FOR HYDRAULIC VALVES



Try Chemiseal V-Type Packings that seal with low gland pressures and operating torque. Extremely resilient, tough, antihesive—they are ideal for either manual or automatically operated valves. Supplied in sets with square-end Teflon adaptors. Ask for Catalog No. 810-V.

FOR "O"-RING APPLICATIONS SELECT THE "PACKING PACKAGE"

Chemiseal "O" Rings of resilient, homogeneous synthetic rubber—absolutely non-porous and withstanding a wide temperature range. Available in both commercial and AN Compounds. And . . .

Chem-o-green Back-up Rings of chemically inert Teflon, greatly lengthen "O" Ring life and prevent extrusion. Available in solid, split and the spiral type preferred by engineers. Ask for Catalog OB-1152.

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY
Representatives in Principal Cities Throughout the World

Circle 122 on Reader Service Card

USEFUL LITERATURE

Continued

ROTARY SOLENOIDS . . . From G. H. Leland Inc., you can obtain a 30 page engineering booklet which is divided into 8 sections. These sections cover a general description of rotary solenoids and switches, mechanics of control-selective and control-stepping, physical data, power data and standard models. The booklet includes many electrical circuit drawings showing the application of this equipment.

Circle 207 on Reader Service Card

POWER PACKAGE UNITS . . . Advanced Hydraulics Inc., offers a 4 page leaflet illustrating custom-built hydraulic equipment. The catalog states that the company makes it a point to build equipment beyond its required capacity to assure long life and trouble free operation. Each type of equipment is thoroughly tested to assure best hydraulic performance.

Circle 208 on Reader Service Card

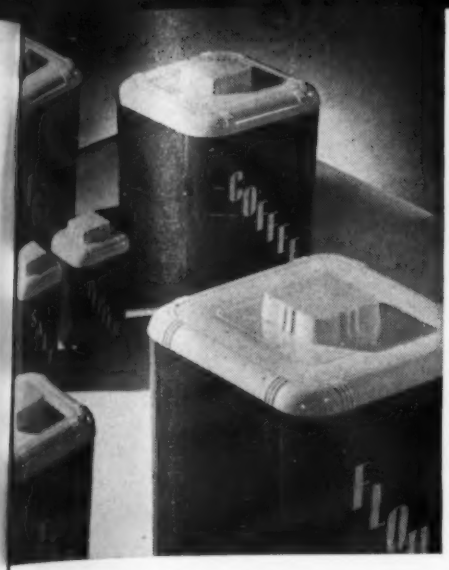
SEALS AND GASKETS . . . A 4 page brochure issued by Franklin C. Wolfe Company, discusses briefly their standard products and services for sealing bolts, flanges, studs, AN fittings, hatch covers etc. The products are designed around the principle of controlled confinement of the sealing gland.

Circle 209 on Reader Service Card

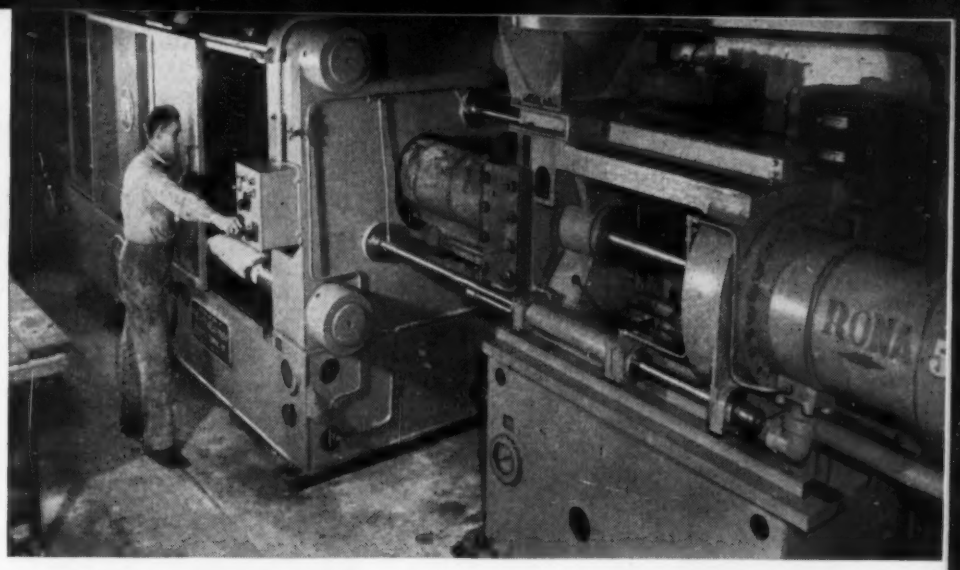
AFTERCOOLERS . . . An 8 page bulletin L 802-B2B offered by Worthington Corporation points out why aftercoolers pay. The bulletin illustrates two types of aftercoolers, a chart shows the weight of moisture per thousand cubic feet of saturated air at various pressures and temperatures. Dimensions for both types are also given.

Circle 210 on Reader Service Card

Continued on page 42



NO MORE PROBLEMS. The production of plastic household items by Rona Plastic Corporation was slowed down by an inadequate hydraulic oil. A switch to Sunvis 999, over a year ago, restored it to normal.



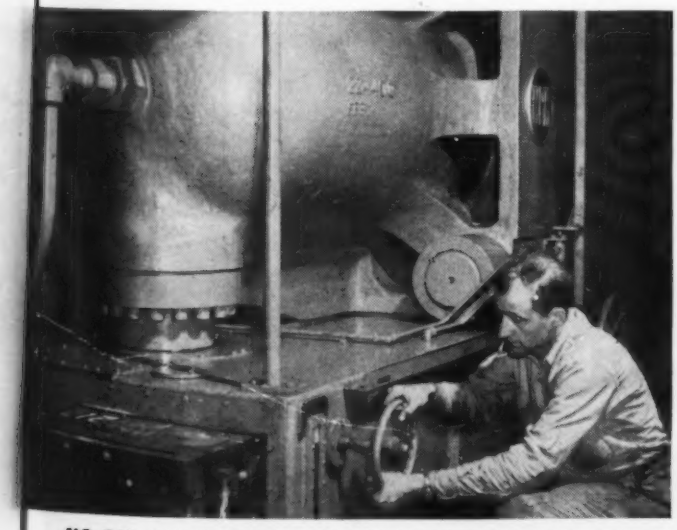
PRESSURE LOSSES ENDED. There are few plastic molding machines as big as this 60 ounce model. It exerts a pressure of 1,000 tons. Because the hydraulic oil formerly used sludged up and thinned out, it could not maintain this pressure. But Sunvis 999 has fully met these severe requirements, as well as those of Rona's nine other hydraulic machines of varying sizes.

PLASTIC MOLDER'S BOTTLENECK ENDED BY SUNVIS HYDRAULIC OIL

More than a year ago Rona Plastic Corporation, New York City, had trouble with its hydraulic molding machines. The machines functioned erratically due to oil sludge sticking the control mechanisms. In addition, the oil thinned out excessively at normal operating temperatures, and resulted in the loss of proper clamping pressures on the dies. To keep the machines going at all, it was necessary to drain, clean, and entirely recharge the systems at frequent intervals.

A Sun representative, called in by Rona, studied the problem and recommended Sunvis 999. He knew it would put an end to pressure losses, because, even at elevated temperatures, it does not decrease in viscosity as much as most other oils. He also knew its exceptional stability would end the sludging problem.

Sunvis 999 proved to be the answer to all Rona's hydraulic oil problems. The original charges, with minimum make-up, are still giving good service. Rona can expect the same performance for a long time to come, because experience shows that under normal operating conditions, Sunvis 900 Series Oils are *good for the life of the equipment.*



NO OIL CHANGES HAVE BEEN NEEDED. Before Sunvis 999 was adopted, the oil in each of the machines had to be changed frequently (the one pictured holds 450 gallons). The original charges of Sunvis 999 have been in use now for more than a year.

Department AH-5

Sun Oil Company, Philadelphia 3, Pa.

I am interested in knowing more about Sun Hydraulic Oils. ☐ I would like to consult with a Sun representative. ☐ Send the booklet "Hydraulic Fundamentals and Industrial Hydraulic Oils."

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

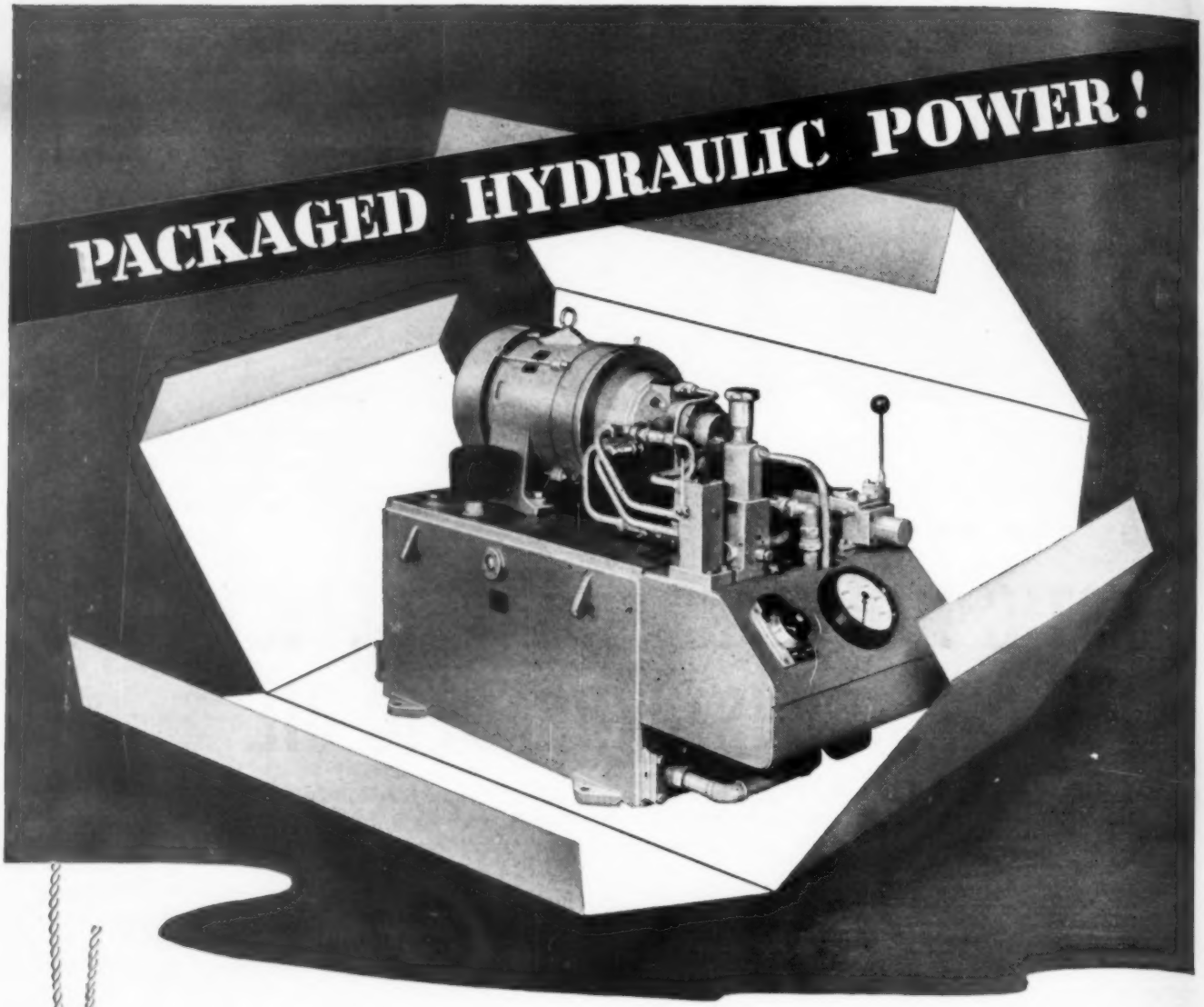
TECHNICAL ASSISTANCE AVAILABLE. Sun's engineers are at your service for consultation on all hydraulic oil applications. It will pay you to utilize the experience they have gained in solving a wide variety of problems in many different industries.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO

PACKAGED HYDRAULIC POWER!



This compact unit, comprising 'Electraulic' axial plunger pump and motor, control valves and oil supply tank, is supplied complete and ready for installation. Just bolt down and couple up three pipes! The unit illustrated develops 15 H.P. at 7000 p.s.i., and is arranged to control the speed and direction of all operations.

ELECTRAULIC
REGD. TRADE MARK

HIGH SPEED PUMPS
DIRECT HYDRAULIC SYSTEM

TOWLER BROTHERS (PATENTS) LTD., RODLEY, Nr. LEEDS, ENGLAND

Sole Agents: U.S.A. and Canada.

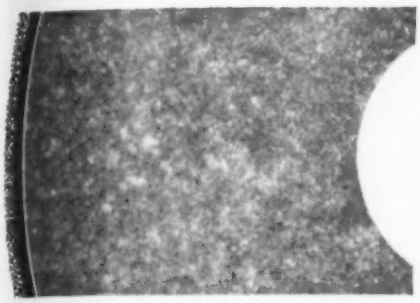
MACMILLIN ENGINEERING CORPORATION

1737 HOWARD STREET, CHICAGO 26, ILL. Ambassador 2-1191

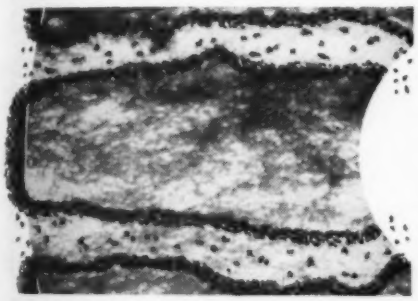
GRADUATED DENSITY

makes MICRO-KLEAN the most effective filter on the market!

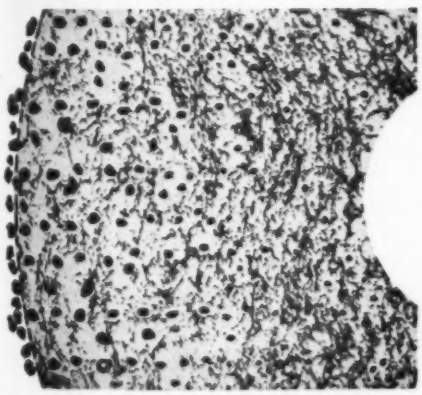
How MICRO-KLEAN compares with other cartridge filters



***Compare* MICRO-KLEAN with FILTERS WITH THE SAME DENSITY THROUGHOUT.** The filter media density is the same on the pressure and discharge surfaces of the element; therefore, dirt accumulation is largely on the outside surface, choking the cartridge ("plastering") and reducing the effective filter life.



***Compare* MICRO-KLEAN with FILTERS WITH HAPHAZARD DISTRIBUTION OF FILTER MEDIA.** Uneven haphazard media density permits fluid to find channels through the filter, and pass solids larger than the minimum filter spacing.



***Now Look* at the advantages offered by MICRO-KLEAN.** See how the fibre density increases toward the discharge side of the MICRO-KLEAN filter cartridge? In effect, every Cuno MICRO-KLEAN cartridge is an infinite multiplicity of screens, ranging from relatively coarse on the outside down to 10 microns in the center. Because of MICRO-KLEAN'S graduated density in depth, particles are entrapped within the entire depth of the filter element, giving the cartridge a much longer effective life. Standard cartridge size is 9¾" long by 2¾" O. D., in densities of 10, 25 and 50 microns.

MICRO-KLEAN gives you

- greater dirt holding capacity
- absolute protection against rupturing or channeling of the cartridge
- longer effective cartridge life

REMEMBER . . . IF YOU CAN PUMP IT, CUNO CAN FILTER IT

M.3.C

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

MICRO-KLEAN FILTER HALVES CARTRIDGE REPLACEMENT COSTS

Resin Impregnated Fibre Cartridge Lasts Twice as Long

MICRO-KLEAN's graduated density-in-depth allows greater capacity for dirt accumulation within the micronic cartridge, giving twice the effective life of an ordinary filter cartridge. Thus, cartridge replacement costs are cut in half. And the high porosity of MICRO-KLEAN permits higher flow rates, enabling you to speed up fluid processing.

Each fibre of the MICRO-KLEAN filter is positively bonded in position by resin impregnation and polymerization. This provides great structural strength and complete protection against channeling, rupturing, shrinking or distortion.

Cuno's exclusive method of felting fibres permits precision control of the cartridge structure, assuring MICRO-KLEAN users of consistent, uniform filtration.

MICRO-KLEAN's low pressure drop operation permits full-flow service on gravity, low pressure, or suction lines—with no loss in operating efficiency.

Try a MICRO-KLEAN cartridge in your replaceable-element type filter. Standard sizes fit many types of industrial filters now in use. Special lengths of MICRO-KLEAN cartridges can be supplied for built-in installations. MICRO-KLEAN cartridges also come in a wide range of Cuno housings.

Take advantage of Cuno's unique "money-back" offer: if MICRO-KLEAN doesn't outperform any filter cartridge you have previously used, we'll send you *double* your money back. Send coupon today for MICRO-KLEAN bulletin.

M.3.1

Cuno Engineering Corporation
Dept. 351 C South Vine Street, Meriden, Conn.

I'm interested in your "money-back" offer. Please send me bulletin on Cuno MICRO-KLEAN.

Name.....

Company.....

Address.....

City.....Zone....State.....

Circle 23 on Reader Service Card

What do you want CONTROLLED with this new NP Power-Check?

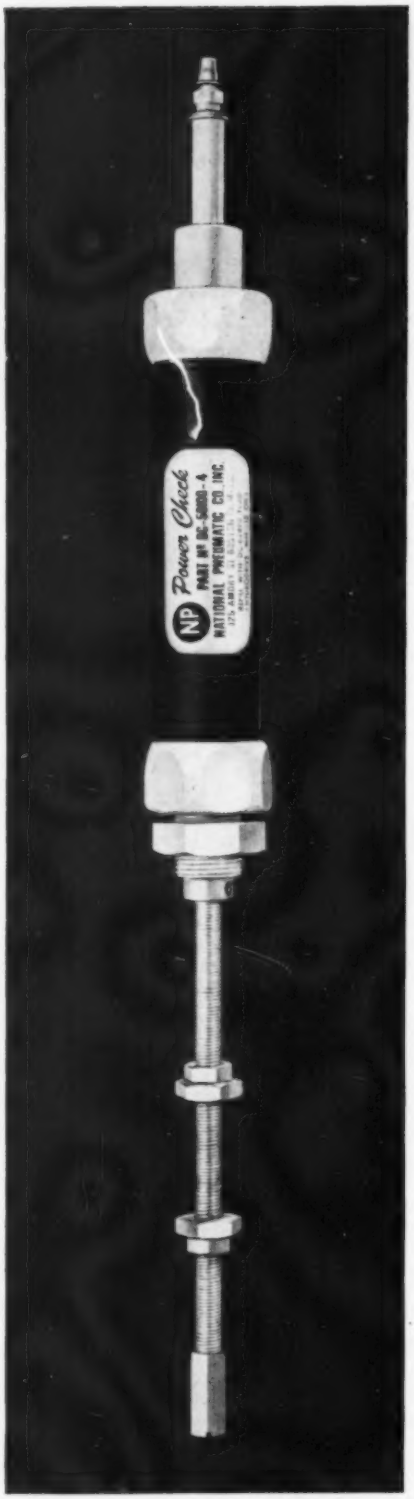
Now you can have precision speed control of any manually- or pneumatically-powered straight line motion.

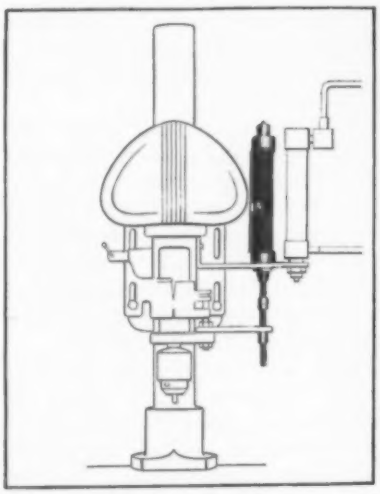
National Pneumatic's new POWER-CHECK introduces and maintains a precise and uniform control *hydraulically* for all or part of the stroke.

The degree of "power-checking" is predetermined and adjustable. Eliminates the need for special skill. Completely self-contained — easily applied — requires almost no maintenance. 2, 4, 6, 8 inch strokes.

What's your application?

FREE BULLETIN No. DC-208-B. Write National Pneumatic Co., Inc., 125 Amory Street, Boston 19, Mass.





POWER-CHECK, applied to *manually-operated* or *pneumatically-operated* equipment, "smoothes out" power *hydraulically.* Typical applications: drill presses, grinders, milling machines, etc. Work produced is cleaner — fewer rejects — less tool breakage.

NP

POWER-CHECK

National Pneumatic Co., Inc.

Boston 19, Mass.

DISTRIBUTORS — ATTENTION. A few of the best industrial areas may become available to distributors of good standing. Write for information.

USEFUL LITERATURE

Continued

ROLLER GEAR DRIVE . . . Ferguson Machine & Tool Co. has issued Bulletins 101, 102 and 103; describing a new type of indexing mechanism, designed to repalce Geneva drives and other indexing devices. Characteristics of the drive, how to determine the type of drive necessary for individual operating requirements and how to select the proper drive for a particular installation are explained.

Circle 211 on Reader Service Card

BRAKE FLUIDS . . . You can get much basic data on the specifications and properties of hydraulic brake fluids, from a booklet prepared by The Dow Chemical Company. The four components of brake fluids: lubricant, solvent and coupling agent, solvent and rubber swelling inhibitor, and inhibitor system are described. Tables summarize the S. A. E. specifications for brake fluids; and the properties of selected polyglycols, Dow products, glycols and combinations.

Circle 212 on Reader Service Card

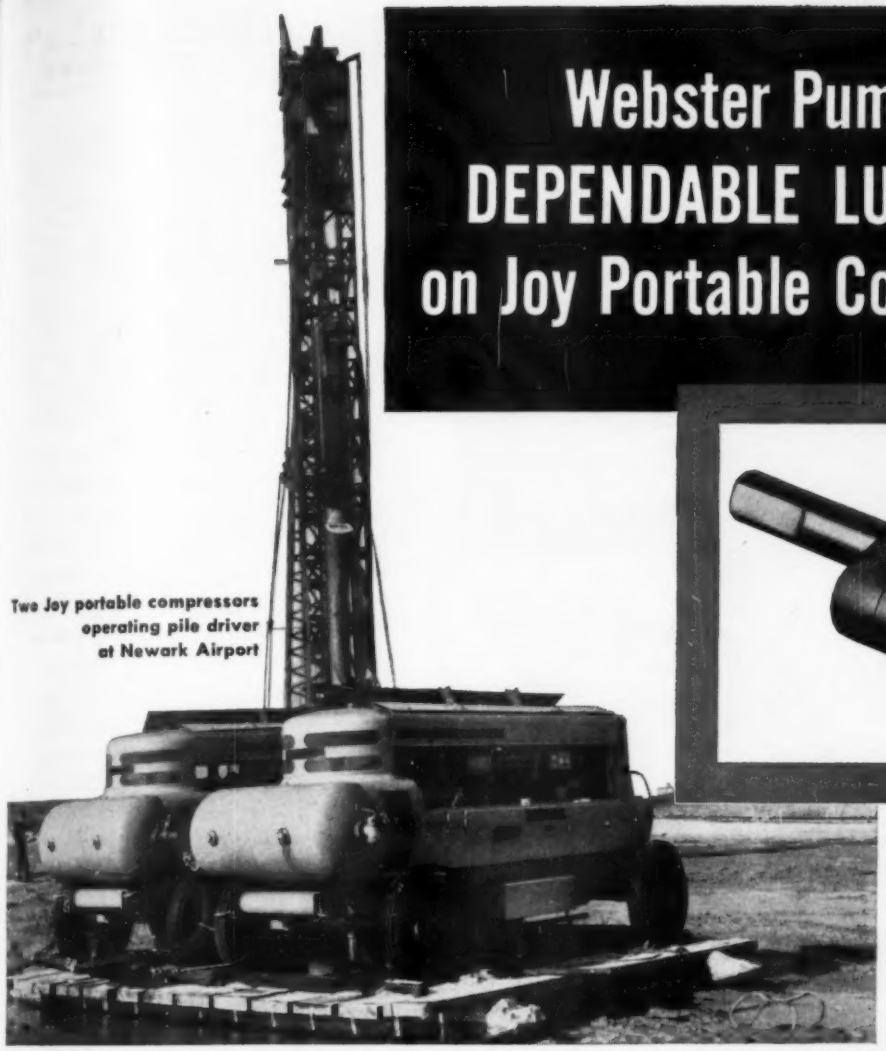
ELECTRICAL CONTROLS . . . Ward Leonard Electric Co., has issued a 24 page bulletin describing and listing the most complete line of power rheostats for industrial and commercial control applications. The bulletin is well illustrated, showing dimensions, specifications and mounting features.

Circle 213 on Reader Service Card

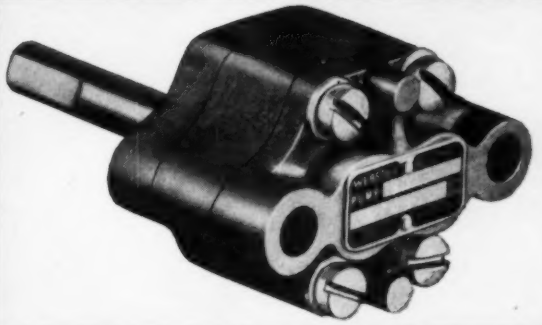
TANK AND VALVE UNIT . . . Hydraulic Equipment Company has issued a data sheet TV 30-10149 showing model TV 30 combination tank and valve unit, which can be supplied from one to three plungers to control individually single-acting or double-acting hydraulic cylinders. The bulletin lists dimensions and construction specifications.

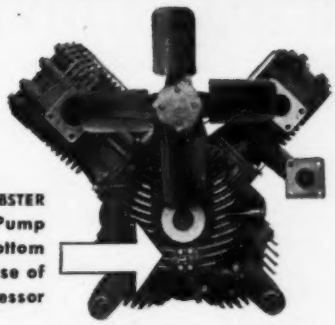
Circle 214 on Reader Service Card

Webster Pumps give DEPENDABLE LUBRICATION on Joy Portable Compressors...



Two Joy portable compressors operating pile driver at Newark Airport





WEBSTER Pump mounted at bottom of crankcase of Joy Portable Compressor

• The exceptionally heavy work demanded of the Joy Manufacturing Company's portable compressors shown above requires a reliable and unfailing system of force-feed lubrication. This is provided by positive-displacement WEBSTER Gear-type Oil Hydraulic Pumps. The pump is face-mounted and gear-driven from the crankshaft.

Behind every WEBSTER Hydraulic Pump is the skill gained during nearly a quarter-century of experience. Their dependable, efficient performance has stood the test of time under widely varying operating conditions. WEBSTER Hydraulic Pumps—available in a *full line* from 10 gph. to 10 gpm. at pressures up to 1200 psi. at speeds of 3600 rpm. or less—lend themselves to many forms of application, and *to modification to special installations.*

Do *you* require pumps for lubrication, oil circulating, transfer, filtering or oil hydraulic power application? Chances are that one of our present 90 models will fill your need; if necessary, we can make one that will! Finding out the facts involves no obligation; just fill in and mail the coupon today.

Oil Hydraulics Division, Webster Electric Company
Dept. AH-5, Racine, Wisconsin

Send me information on WEBSTER Hydraulic Pumps as checked:

Capacity (Approx.)_____G.P.M.
Pressure (Approx.)_____P.S.I.
Pump Speed_____R.P.M.

Name and Title_____

Firm Name_____

Street Address_____

City_____ Zone_____ State_____

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE WISCONSIN

"Where Quality is a Responsibility and Fair Dealing an Obligation"

WEBSTER ELECTRIC COMPANY, RACINE, WISCONSIN • EST. 1909

WIRE-BRAIDED RUBBER HOSE IN *Economy* LENGTHS

Now! From the world's newest, most modern equipped factory comes a complete line of wire-braided rubber hose. Made in lengths that are economically adaptable to your requirements!

Republic WIRETEX Hose has all the desirable characteristics of flexible, high-quality rubber hose. It bends naturally to fit any connection. It's not weakened by vibration or flexing. It resists a wide span of temperature variance between—40° F. and +200°F. It's oil, grease and abrasion-resistant and won't rust or corrode.

Republic WIRETEX Hose is continuously reinforced with multiple braids of wire that maintain diameter dimensions despite high-pressure surges from 400 to 5,500 p.s.i. Republic WIRETEX Hose is available with either rubber or textile covers. Get the facts today! Whenever selection requirements for high, medium or low-pressure carriers for any gases or liquids demand hose of great strength, flexibility and long life, your answer is Republic WIRETEX!

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

USEFUL LITERATURE

Continued

AIR-FILTER . . . Instrument-quality air for all compressed air applications is now available from ordinary plant air. This is described in an illustrated bulletin issued by Hankinson Corporation. Known as the Condensifilter, it features a disposable filter cartridge. Construction features, technical data and dimensions are outlined.

Circle 215 on Reader Service Card

TUBE FITTINGS . . . Flodar Corporation has published a new 28 page illustrated catalog featuring their "Griptube", flare type AN dimensions with improved spring steel sleeve, and their "Fluid Fortress", no-flare type, eliminates flaring, threading, soldering, welding. Both fittings feature the alloy spring steel sleeve which masters the problem of holding high fluid pressure and produces a leak-proof hydraulic system; cantilever spring fingers to absorb tube vibrations; and a short radius swing, permitting close mounting of tee and elbow fittings. Both types are well illustrated and their construction shown. Engineering specifications and dimensions of both types are given. Also included is one section which describes steel pipe fittings and accessories.

Circle 216 on Reader Service Card

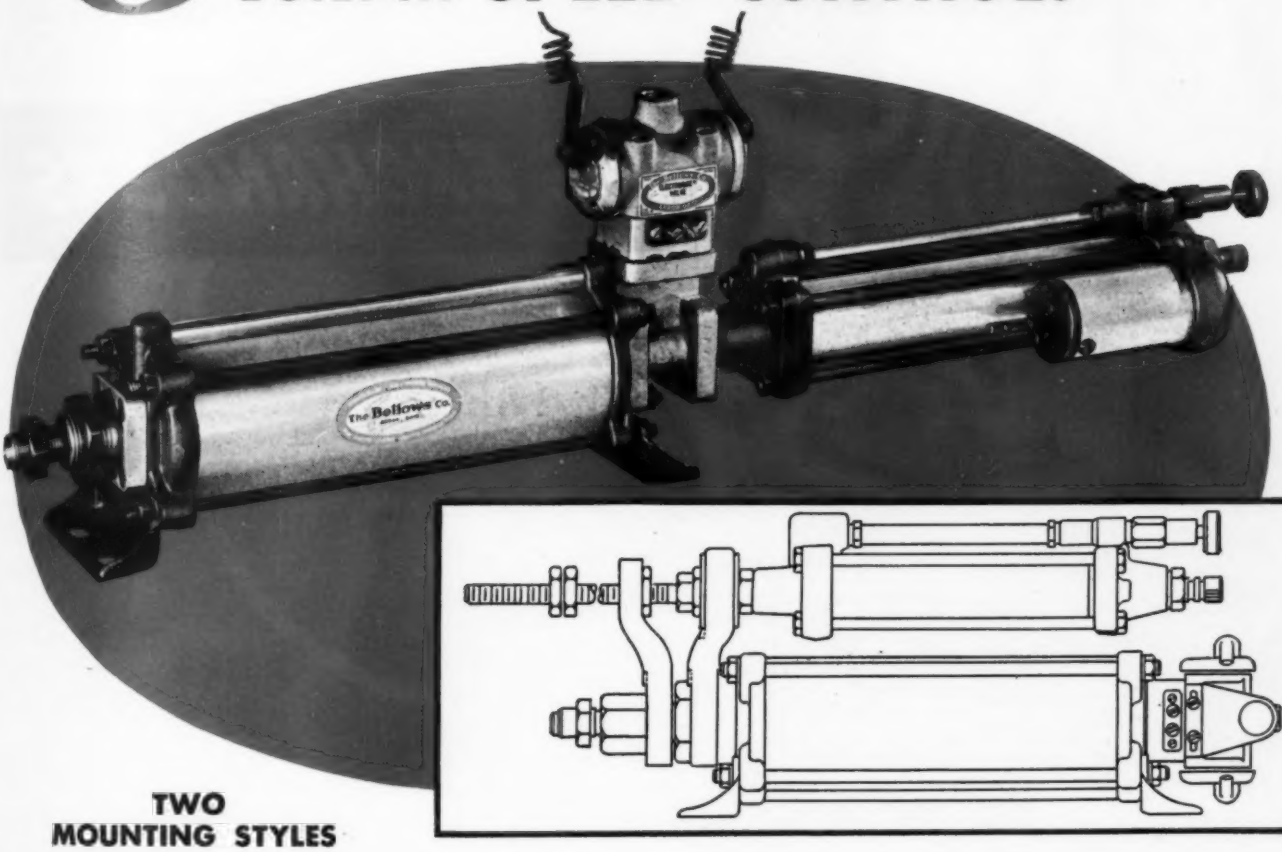
ELECTRIC MOTORS . . . Here is a 12 page folder prepared by Electric Specialty Company which details their line of electrical motors and power sources. The booklet illustrates typical applications and emphasizes the company's facilities to design special motors to meet your exact requirements. Factors for the selection of motors are tabulated and specifications of standard motors including a.c. polyphase induction motors for hydraulic pump and air compressor drives are shown.

Circle 217 on Reader Service Card

Continued on page 128

This Air Cylinder Combines

1 BUILT-IN HYDRAULIC CONTROL
2 BUILT-IN ELECTRIC CONTROL
3 BUILT-IN SPEED CONTROLS



TWO MOUNTING STYLES

The Bellows Air Motor and Hydro-Check (Model HCB-EM) is available arranged in tandem as shown above, or in parallel, as sketched.

●

Combination units of Air Motor and Hydro-Check are also made with any one of six other Bellows directional valve arrangements; and, of course, Air Motors and Hydro-Checks are available as separate units.

In one compact packaged power unit are built-in controls to cover every phase of air cylinder operation. Built-in hydraulic control of piston rod movement gives the characteristic smoothness of hydraulic operation, yet retains the speed and flexibility of air power. Built-in electrically controlled directional valve permits quick, positive, remote control, or easy electrical synchronization with other machine elements. Built-in speed controls permit exact control of piston rod speed in either or both directions.

This combination of Bellows Air Motor and Hydro-Check is available in five bore sizes: 1¼", 1¾", 2½", 3⅜" and 4½" in standard stroke lengths up to 18".

Here is air cylinder power at its best — fast, flexible, safe, and smooth.

BULLETIN CL-50 TELLS THE STORY. WRITE FOR IT TODAY!
DEPT. AH-553

Controlled-Air-Power

The Bellows Co.

AKRON 9, OHIO

699-A

FOR FASTER, SAFER, BETTER PRODUCTION

for twofold temperature control in this Impco plastic molding equipment

Impco No. 3 Temperature Regulator, equipped with a Ross Exchanger.

ROSS EXCHANGERS

Impco VF 822A, 22-Ounce Injection Molding Machine, equipped with a Ross Exchanger.

At full 22-ounce capacity, this IMPCO Injection Molding Machine is designed to apply 15,000 psi on the material.

To maintain that pressure — *to guard against hydraulic power losses through pump slippage* — Impco furnishes a Ross Type BCF Exchanger. Thinned-out hydraulic fluid, caused by overheating, is thus prevented. Ross Exchangers keep temperatures under control. "Every plastic molding machine we manufacture utilizes a Ross Exchanger," states the Improved Paper Machinery Corporation. *Productivity is thereby insured!*

In those installations where an Impco Temperature Regulator is used—a Ross Exchanger again plays a vital role . . . safeguarding against rising temperatures of the oil or water pumped through the mold. For, Ross Exchangers are also standard components of this IMPCO equipment. Hence, dependable protection becomes twofold. *Qualitative control is also insured!*

So too, do other leading manufacturers, like Impco, build temperature control into their products by factory-installing Ross Exchangers on *all* types of hydraulic equipment: *extrusion and metal drawing presses, die casting machines, calenders, stoker drives, as well as injection and compression molding machines.*

Available in a wide range of pre-engineered, fully standardized designs and constructed of durable copper and copper alloy, Ross Type BCF Exchangers have earned universal acceptance. To find out what they can do for you, write for Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1464 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

Turchan and NILES meet demands of JET work with faster, more accurate tracer-controlled duplicating

- Accurate to ±.001" plus faster speeds
- Allows higher contouring, deeper boring
- No costly high-skilled help required
- Makes one machine do the work of three
- Saves 80% to 600% in production costs

Pictured: Turchan Follower integral with Niles 42/50" Sidehead Lathe, courtesy Niles Tool Works, Hamilton, Ohio. Other Turchan attachments available for any standard lathe, miller, shaper, planer or grinder. Write for details.

Write for Bulletin

Tells how to get more and better work from your present machines, without skilled help and special tools.

GET AN ESTIMATE: Send a sketch and specifications of any job. Give make of machine. We'll show you how to produce it better, faster, at lower cost.

Turchan FOLLOWER MACHINE COMPANY

8259 LIVERNOIS AVENUE DETROIT 4, MICH.

Circle 119 on Reader Service Card

Designed Right

for **both** jobs

Ready for use as either PUMP or MOTOR without adjustments

On pump applications, you get extra value from Pump/Motors—high volume oil delivery plus husky, close-coupled design that withstands *long, hard, continuous duty* at all pressures up to the full 2000 psi maximum. Four sizes, each available with a choice of cam rings for varying needs, provide a total of sixteen different models with pumping capacities ranging from 3 to 70 gpm.

For fluid motor needs, Pump/Motors give you smooth-running, high-torque operation plus compact ruggedness that can take the punishment of continuous operation under full load. The ideal transmission for rotary drive needs! Shaft rotation can be in either direction without internal adjustments. Eleven models in four different sizes offer torque ratings from 13 to 257 inch-pounds per 100 psi.

Pump/Motors are *designed right*—for heavy-duty 2000 psi requirements—for complete hydraulic balance—for dual-purpose efficiency—for simplicity—for longer life—for lower maintenance cost—for quick, economical adaptation to the widest possible range of *pump and motor needs.* Compactly built in three simple, sturdy components, they feature quickly interchangeable cam rings . . . no changes necessary for either clockwise or counterclockwise rotation . . . and full hydraulic balance in both *vanes and rotor.* They're today's biggest value for both *pump and motor* requirements in the 2000 psi range. Write today for Pump/Motor Bulletin P-5.

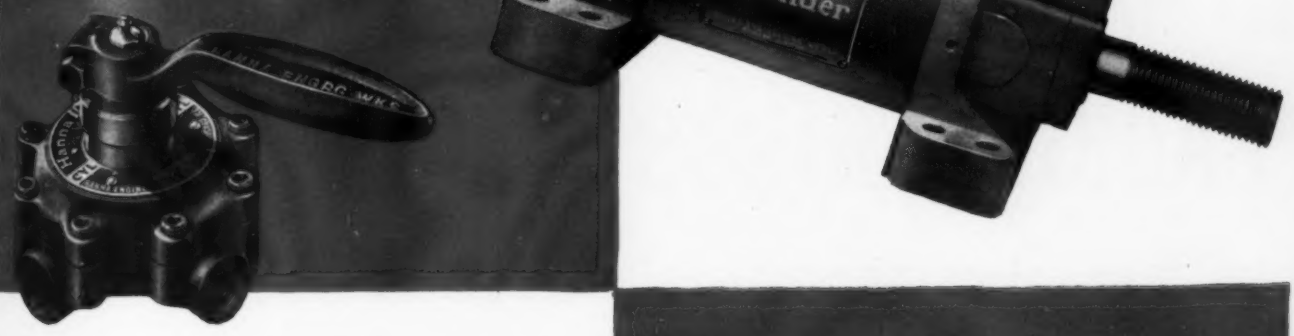
The DENISON Engineering Co.
1166 Dublin Rd., Columbus 16, Ohio
Branch Offices and Field Engineers in Principal Cities

DENISON HydrOILics

Denison makes pumps, pumping units, controls and fluid motors for circuits up to 5000 psi—They're *"The Finest Money Can Buy!"*

Hanna controlled power

the perfect combination for most efficient power with exacting control!



Hanna valves

Here's Hanna positive control as you need it—for hand, foot, cam or push button actuation . . . to provide manual, semi-automatic, automatic or remote controlled operation. Combined with Hanna pneumatic or hydraulic cylinders, Hanna Valves give you the perfect combination for most efficient power with exacting control.

FREE VALVE CATALOG

Hanna Catalog 254 describes and illustrates the variety of cylinder control valves available for every purpose. Write for your copy today!

Hanna cylinders

Here's controlled power as you need it—from a few pounds to a massive 50 tons of force . . . from inches to feet of sensitive movement. Hanna air and hydraulic power is ready for you to put to work . . . available in a wide variety of mounting styles to meet your specific controlled power requirements.

FREE CYLINDER CATALOGS

Catalog 233-A contains complete descriptions and specifications on Hydraulic Cylinders. Catalog 236 contains complete descriptions and specifications on Pneumatic Cylinders. Write for one or both TODAY!

Hanna Engineering Works

1741 Elston Avenue • Chicago 22, Illinois

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

See for yourself

why R/M VEE-FLEX® PACKING RINGS

seal themselves automatically

Take a look at this cut-away view of a nest of R/M Vee-Flex Packing Rings. Note how the surface of each ring is convexly curved where it touches the next ring to it. Now imagine the hydraulic pressure stroke occurring. The action, as you can easily see, will be instantaneously *up* and *out*—producing an automatic seal laterally against the stuffing box wall and longitudinally ring against ring. Photoelastic analyses,* corroborated by radial pressure tests,* prove that maximum sealing performance occurs at a point slightly below mid-width on the sealing area. When the pressure is relaxed, the rings return to normal position.

If you are packing pumps, valves, rams, presses, cylinders, accumulators or other equipment, R/M has Vee-Flex Rings to meet your most exacting requirements —five different types, for example, seal against pressures in excess of 6000 psi. Different types are available for service against air, gas, steam, oil, water, foods and other commercial fluids.

Write for R/M Vee-Flex Bulletin giving complete data and table of sizes.

**Performed at the Franklin Institute Laboratories for Research and Development.*

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic N.J.; Neenah, Wis.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels
Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916

Yosemite Falls, Yosemite National Park, drops a total of 2,425 ft. in three leaps; Upper Fall, 1,430 ft.; Middle Cascade, 600 ft.; Lower Fall, 320 ft. In spring the roar of this mighty cascade can be heard throughout the upper Yosemite Valley.

LOGAN AIR CONTROL VALVES

Model 6245—4-Way, 2-Position

- BALANCED PISTON
- COMPACT DESIGN
- EASILY INSTALLED
- SELF-CLEANING

79 MODELS

MOST MODELS STOCK DELIVERY

Let Logan Engineers help you design your Air and Hydraulic Circuits

Model 6540
4-Way, 2-Position

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

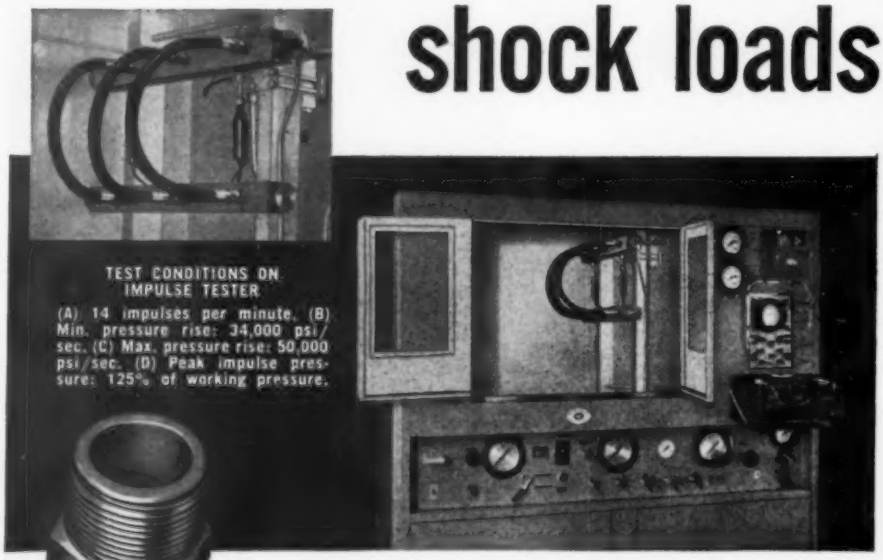
AIR CONTROL VALVES, Cat. 100-4 · AIR CHUCKS, Cat. 70-1 · AIR CYLINDERS, Cat. 100-1 · AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 · COLLET GRIP TUBE FITTINGS, Cat. 200-5 · HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 · HYDRAULIC POWER UNITS, Cat. 200-1 · SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EXPORT-MOTION

LOGANSPORT MACHINE CO., INC., 832 CENTER AVE., LOGANSPORT, IND.

Subjected to toughest hose test . . . yet

still OK after 147,000 shock loads



TEST CONDITIONS ON IMPULSE TESTER

(A) 14 impulses per minute. (B) Min. pressure rise: 34,000 psi/sec. (C) Max. pressure rise: 50,000 psi/sec. (D) Peak impulse pressure: 125% of working pressure.

RESISTOFLEX INDUSTRIAL HYDRAULIC HOSE ASSEMBLIES

offer high burst strength, too!

The hydraulic impulse test, as outlined in military spec. MIL-H-5511, shows how well these *industrial* hose assemblies resist fatigue.

To this 100,000 cycle test, while plenty tough by itself, Resistoflex added a 160°F requirement—making it the toughest hose test yet. Despite this, Resistoflex medium-high pressure assemblies were still going strong after 147,000 cycles . . . at which time attempts to fatigue the assemblies were abandoned as futile.

Built with tough compar tube and high strength synthetic fibre-braid reinforcement, Resistoflex hose assemblies also provide five other features for *more hose value per dollar:*

1. High burst strengths – stay high even as working age increases.
2. High pull strength – more than 3500 lbs. for ½" hose. Couplings won't pull out even under this tension!
3. High impact strength – hose returns to original cross section after crushing load.
4. Full flow fittings – fitting bore equals hose I.D. – Hose constriction at crimp is less than 5%.
5. No gumming or clogging of hydraulic circuit – Compar tube inert to all hydraulic oils.

I.D. (inches)	Working Pressure (psi)	Min: Burst Pressure (psi)	Assembly Tensile Strength (lbs.)
¼	2300	9200	900
⅜	2050	8200	2500
½	1800	7200	3500

Write for Data Sheet MH-17.

RESISTOFLEX

CORPORATION

Belleville 9, New Jersey

SPECIALLY ENGINEERED FLEXIBLE RESISTANT PRODUCTS FOR INDUSTRY

Free Literature Offered in this Month's Ads

Continued from page 32

CYLINDERS used for air, oil, water, and gas operations and which provide a large number of variations and adaptations are featured in Bulletin 500 published by Ledeen Manufacturing Co.

Circle 67 on Reader Service Card

BOOSTERS manufactured by Miller Motor Company are fully described in Bulletin B-200. Powered by shop air, hydraulic pressures up to 10,000 psi can be developed.

Circle 72 on Reader Service Card

AIR TRAPS to solve sludge problems, are discussed in Catalog 751 offered by W. H. Nicholson Co.

Circle 76 on Reader Service Card

PRECISION MOLDED PACKINGS manufactured by Periflex Inc. are detailed in a new catalog, which also lists mold data.

Circle 84 on Reader Service Card

ROTARY PUMPS for hydraulic service are fully discussed in catalog 953, published by Geo. D. Roper Corporation. The booklet on how to solve pumping problems is also available.

Circle 98 on Reader Service Card

RELIEF VALVES featuring a guided piston which cannot get out of line is detailed in a catalog available from Republic Manufacturing Co.

Circle 93 on Reader Service Card

PACKING DATA FILE giving specifications and features of Tannate leather packings is offered by J. E. Rhoads and Sons.

Circle 96 on Reader Service Card

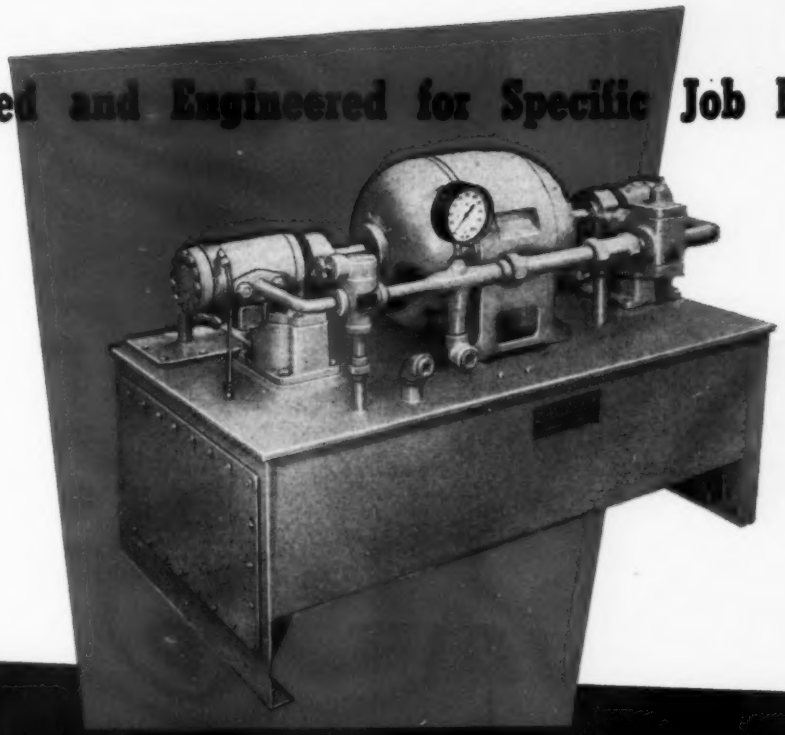
PORTABLE HYDRAULIC POWER UNIT for simplified testing of aircraft hydraulic components and systems, is described in Engineering Bulletin 400, issued by Sprague Engineering & Sales Corp.

Circle 105 on Reader Service Card

AIR CYLINDER of new design, which save up to 40 percent space and eliminates tie rods, is described in Bulletin 8152 offered by Tomkins-Johnson Co.

Circle 113 on Reader Service Card

Designed and Engineered for Specific Job Requirements



HYDRAULIC POWER

- BUILT IN ACCORDANCE WITH J.I.C. STANDARDS
- CAPACITY GEARED TO PERFORMANCE REQUIREMENTS
- SPECIAL DESIGNS AVAILABLE ON REQUEST
- TESTED AND PROVEN IN A WIDE VARIETY OF OPERATIONS

The **CARDWELL MACHINE COMPANY**

Quality A CARDWELL TRADITION SINCE 1829

FRANKLIN AT 19th STREET, RICHMOND 11, VIRGINIA, U.S.A.

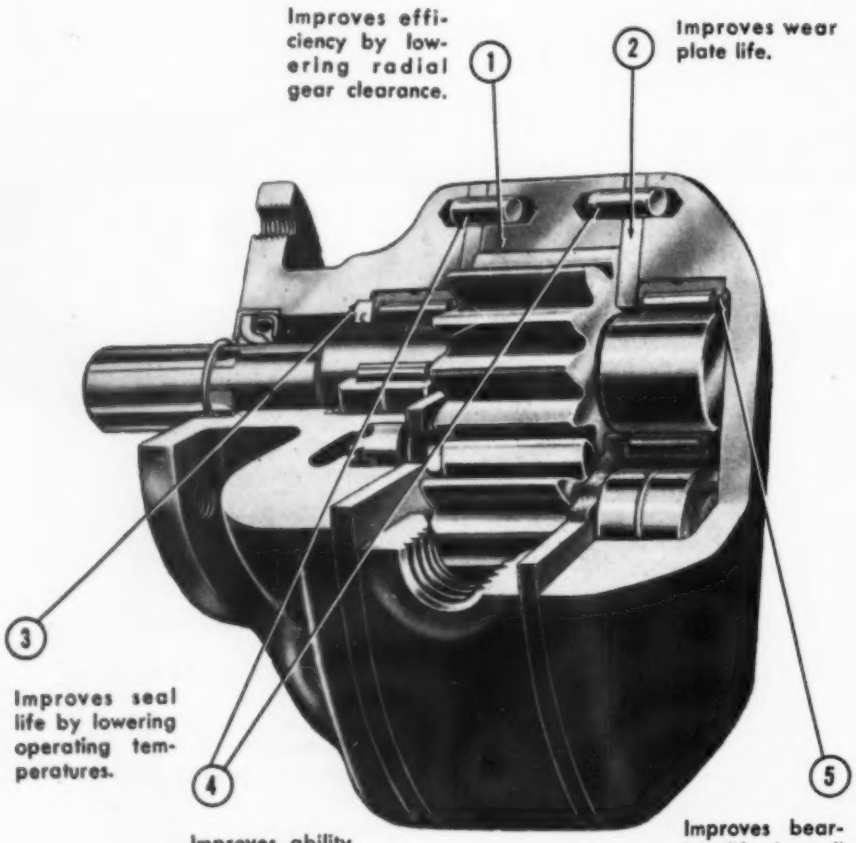
Write for your free copy of this catalog today!

FIVE WAYS 5

PITCHLIGN
Trade Mark

BEARINGS

Improve GEAR PUMPS



1 — Improves efficiency by lowering radial gear clearance.

2 — Improves wear plate life.

3 — Improves seal life by lowering operating temperatures.

4 — Improves ability to operate with normal misalignment.

5 — Improves bearing life by roll control at the pitch line.

Pitchlign is the only small diameter bearing with rollers guided at their pitch line by a cage supported on outboard flanges of the race.

Send For Technical Bulletin SF-6611

Write Today!

RBC

ROLLER BEARING COMPANY OF AMERICA
Sullivan Way, West Trenton, New Jersey

Circle 97 on Reader Service Card

Free Literature Offered in this Month's Ads

Continued

BALL-BEARING SWIVEL JOINTS for safe, economic and efficient services are the subject of a new catalog, 53-C available from Chiksan Company. These joints are designed for hydraulic system pressures up to 3000 psi.

Circle 21 on Reader Service Card

HOSE COUPLINGS AND FITTINGS manufactured by Eastman Manufacturing Company, are described in Catalog 100. Data on complete hose assemblies for hydraulic pressure applications is supplied.

Circle 29 on Reader Service Card

MOLDED PACKINGS for hydraulic and pneumatic service are comprehensively covered in a 32-page manual published by Greene, Tweed & Co. This handbook also describes Palmetto G-T packings. Both application and design data is given.

Circle 44 on Reader Service Card

OIL FILTERS to remove products of oxidation, acids, sludge and moisture are featured in a descriptive bulletin prepared by the Hilliard Corporation.

Circle 52 on Reader Service Card

HEAT EXCHANGERS for safe temperature control are outlined in Bulletin 1.1K5 issued by Kewanee Ross Corporation. Tube type oil coolers, both single and double pass are illustrated.

Circle 61 on Reader Service Card

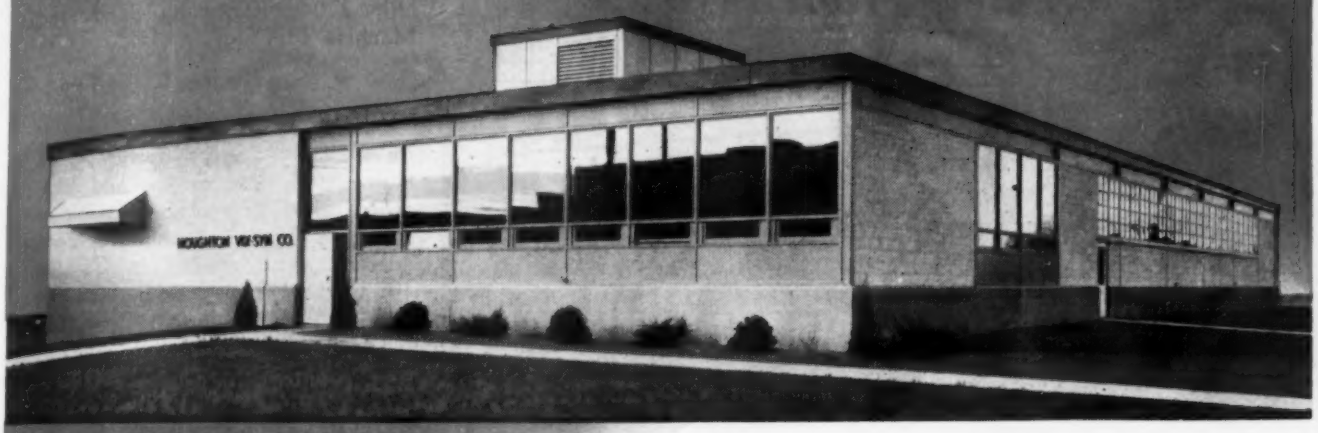
LIMIT SWITCHES and their features are discussed in Specifications Bulletin EM-51, available from the National Acme Company.

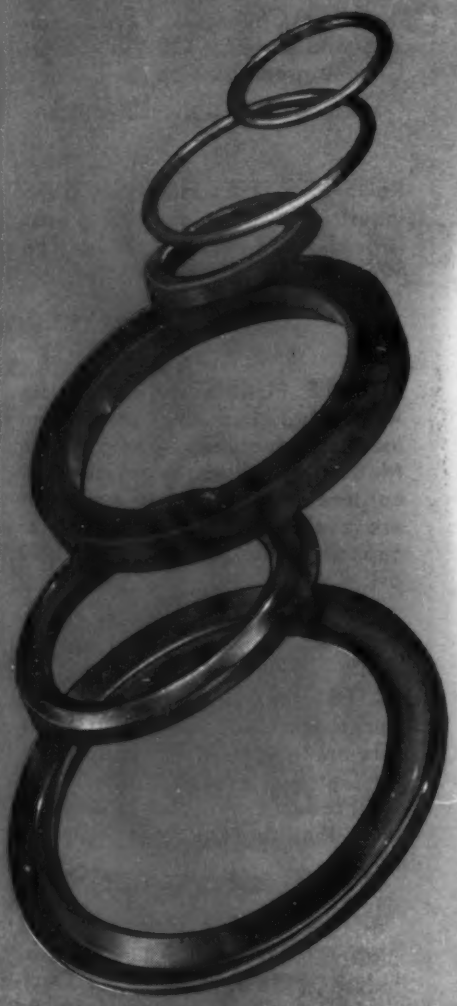
Circle 74 on Reader Service Card

HYDRAULIC CYLINDERS which include modern design features are described in Catalog 103, offered by SP Manufacturing Co.

Circle 103 on Reader Service Card

Growing demand for our PACKINGS calls for expanding production...





New Houghton VIX-SYN PLANT* is getting ready to answer that demand!

YOU—as Houghton packing customers—ordered this modern new plant!

Your increasing requirements for Houghton's VIX-SYN Synthetic Rubber Packings demanded new production facilities—and this newly constructed plant is our answer.

Scheduled to concentrate production on VIX-SYN packings, the new plant is already producing some standard size homogeneous commercial packings—"U" cups, "V" 's and "O" rings—and production is gradually being upped all the time!

Whether you use VIX-SYN packings or VIM Leather packings, the Houghton Man is now in a better-than-ever position to serve you. Your inquiries are invited.

**New Houghton Vix-Syn Co., Hopkins, Minn.*

VIX-SYN and VIM Packings
... products of

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service ...

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Greater Profit

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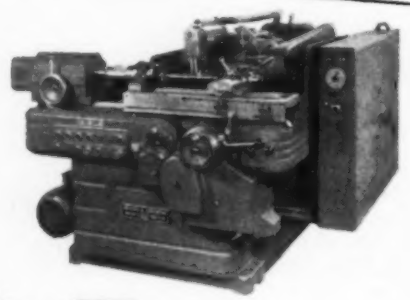
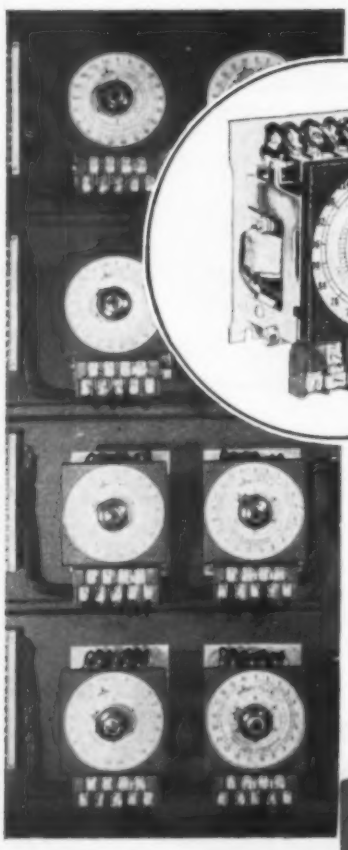
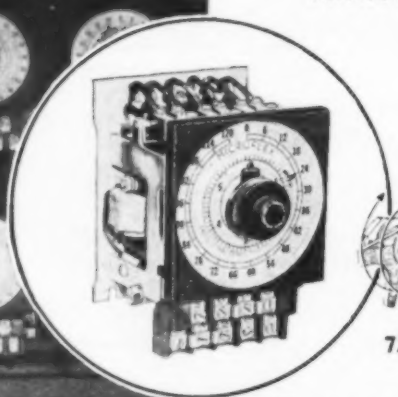
Your machines plus Eagle Timers

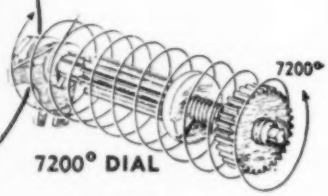


SPEED-UP PRODUCTION WITH MICROMETER ACCURACY





The patented Microflex Threaded Axle and Pinion uses 20 turns of the dial. Multiplied 20 times, 7200°, for more accuracy.



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You can increase the accuracy of your machines, reduce human errors and speed up production, for greater profit. There is a staff of "know-how" engineers at Eagle, ready to suggest the right answer to your production problems without obligation. Let Eagle Automatic timing increase production and profit for you.

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Free Literature Offered in this Month's Ads

Continued

MULTIPLE SECTION SERIES VALVE which permits operation of two or more cylinders under full or varying load are discussed in Bulletin 3104 offered by Sundstrand Machine Tool Co.

Circle 109 on Reader Service Card

REVOLVING JOINTS for use where high speed, low torque and leak-proof rotary connections for air or hydraulic lines on machine tools are needed, are detailed in Catalog 300 issued by Barco Manufacturing Co.

Circle 11 on Reader Service Card

CHEMISEAL PACKINGS are described in two catalogs offered by U. S. Gasket Company. No. 810-V describes Chemiseal V-type packings and catalog OB-1152 covers Chem-o-green back-up rings.

Circle 122 on Reader Service Card

REUSABLE STEEL HOSE ENDS and industrial hose are detailed in catalog H-1451 prepared by The Weatherhead Company.

Circle 128 on Reader Service Card

DOUBLE PUMPS for applications where two hydraulic circuits are used, are featured in new bulletin M 5101, published by Vickers Incorporated. These vane type units are available in a wide range of capacities for service up to 1000 psi.

Circle 126 on Reader Service Card

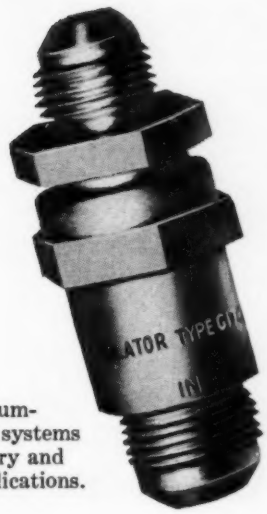
FILTERS for hydraulic systems containing precision valves and actuators are described in Industrial Filter Catalog, available from Purolator Products, Inc. The catalog lists more than thirty different types.

Circle 89 on Reader Service Card

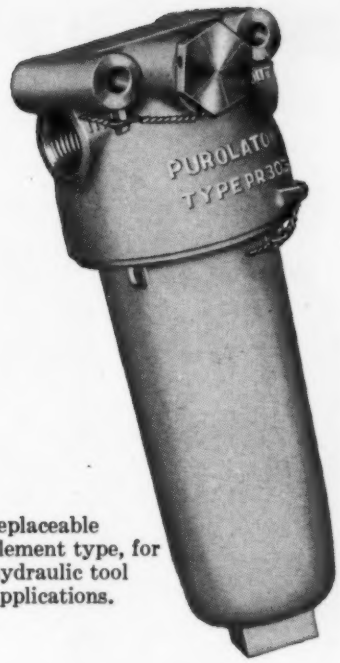
BRONZE PUMPS manufactured by Industrial Pump Division of Oberdorfer Foundries, Inc., are described in 1953 edition of industrial pump catalog.

Circle 77 on Reader Service Card

for high-pressure systems.



for medium-pressure systems in military and tool applications.



replaceable element type, for hydraulic tool applications.

for aircraft hydraulic systems.

for low-pressure, high flow systems.

When filter performance really counts... specify PurOlator

For many years, Purolator* filters have been specified as standard equipment in hydraulic systems where failure might mean disaster . . . as in military and commercial aircraft.

Why not take a tip from the nation's leading plane designers, then—and specify Purolator filters in *all* hydraulic systems containing precision valves and actuators. Purolator hydraulic filters remove contaminants that are the most common cause of valve and piston failure—sludge, oxidation by-products, rust and metal particles.

And remember . . . whenever you specify Purolator, your choice is backed by the world's largest filter research and engineering laboratories, *plus* the world's largest specialized filter production facilities.

Send for the Purolator Industrial Filter Catalog, listing more than thirty different types, including A & N approved filters.

PUROLATOR PRODUCTS, INC., Rahway, New Jersey and Toronto, Ontario, Canada
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PUROLATOR
WORLD'S FINEST OIL FILTER

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Circle 89 on Reader Service Card

Is compact design your problem?

here's how portable electric tool manufacturers solve it with **NEEDLE BEARINGS**

Torrington Needle Bearings are designed into many portable electric tools because their small cross section permits the close shaft-center distances so necessary to compactness.

They have been *performance-proved* through years of successful operation on counter shafts, pinion shafts and spindles in drills, buffers, sanders, grinders and other electric tools.

Since it was introduced nearly twenty years ago, many manufacturers throughout industry have made the Torrington Needle Bearing "standard equipment" for products requiring an anti-friction bearing that's light, compact and has high rated radial capacity.

Why not find out how Torrington Needle Bearings can be used to advantage in your products?

THE TORRINGTON COMPANY, Torrington, Conn., South Bend 21, Ind.

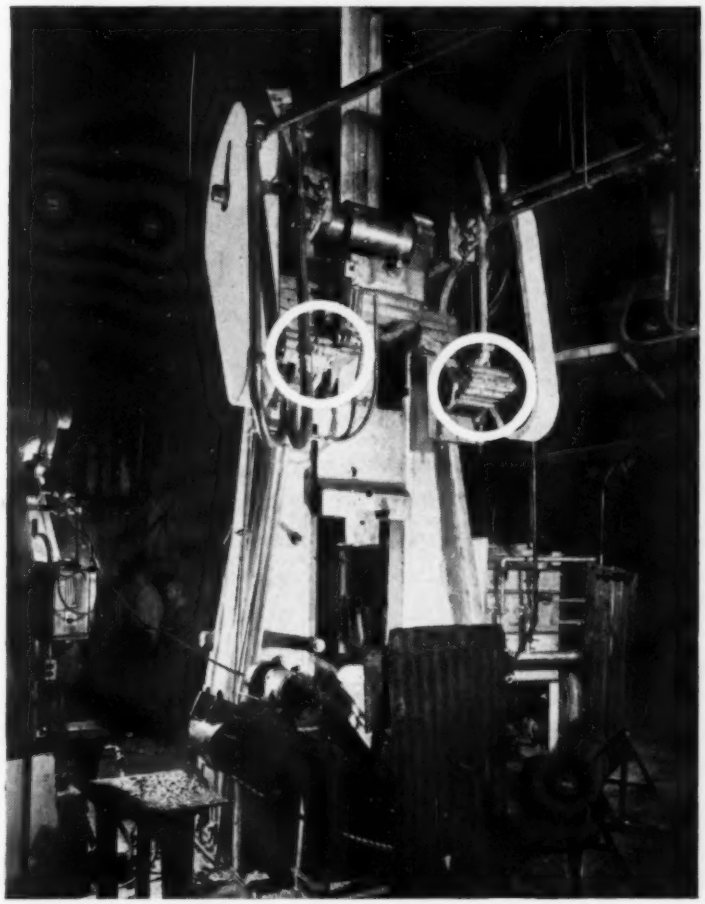
TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

Trade-marks of some of the portable tool companies whose products enjoy the benefits of Needle Bearings.

SKIL PORTABLE TOOLS · STANLEY · MILLERS FALLS TOOLS · SIOUX · PET POWER TOOLS · Speedmatic · Thor · Milwaukee · Black & Decker · Mall

The Most Rugged Hydraulic Unit Ever Designed



This 2000-pound Board-type forging hammer has been in operation for nearly two years.

In that time, the hydraulic motors mounted on the hammer's A-frame have withstood a million earth-shaking shocks as the hammer dropped free to forge hardware for the pole-lines of the nation.

Responsible for this record of stamina without maintenance is the fact that the Berry units have relatively small rotating masses with amply-designed bearings.

More and more industries are finding in Berry "Rotodraulic" units the best solution to maintenance problems not only in connection with vibrating machinery, but also on machine tools, tractive drives, winding machines, earth augers, and many more.

Consult Berry engineers for recommendations on your own equipment. Sales engineering representatives in principal cities.

The Revolutionary BERRY Principle:

- Positive Torque
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PUMPS • MOTORS • TRANSMISSIONS

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When the pressure's on

your best bet is

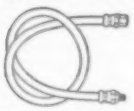
FLEX-O-TUBE

If you use flexible hose in your product or for replacement in your plant, it will pay you to specify Flex-O-Tube. For here is a name that has stood for finest quality and dependable service for more than a quarter of a century.

In the development of new uses for flexible hose, Flex-O-Tube provides you with dependable experience in the field. When used for replacement in industrial maintenance, Flex-O-Tube provides you with a complete range of products that are easy to assemble and long on performance.

Whatever your needs, why not discuss them with the local Flex-O-Tube field engineer. You'll find there are many good reasons why industry has relied on Flex-O-Tube for miles and miles of flexible hose products.

Supplied In Assemblies



Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

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FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

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New National Fluid Power Association Meets May 18, 19

An organization meeting of the new National Fluid Power Association will be held at the Bedford Springs Hotel, Bedford, Pennsylvania, on May 18 and 19. Representatives of plants that design and manufacture hydraulic pumps and hydraulic and pneumatic cylinders and control valves plan to adopt the previously considered Constitution and By-Laws, to elect a slate of officers and directors and to discuss the purposes and objectives of the Association.

The meeting will be open and manufacturers in the hydraulic and pneumatic component and systems fields are invited to write for applications for membership and reservations. Address the temporary Executive Secretary, Barrett Rogers, 1618 Orrington Ave., Room 328, Evanston, Ill.

Advisory Board Named for Aircraft Trade Show

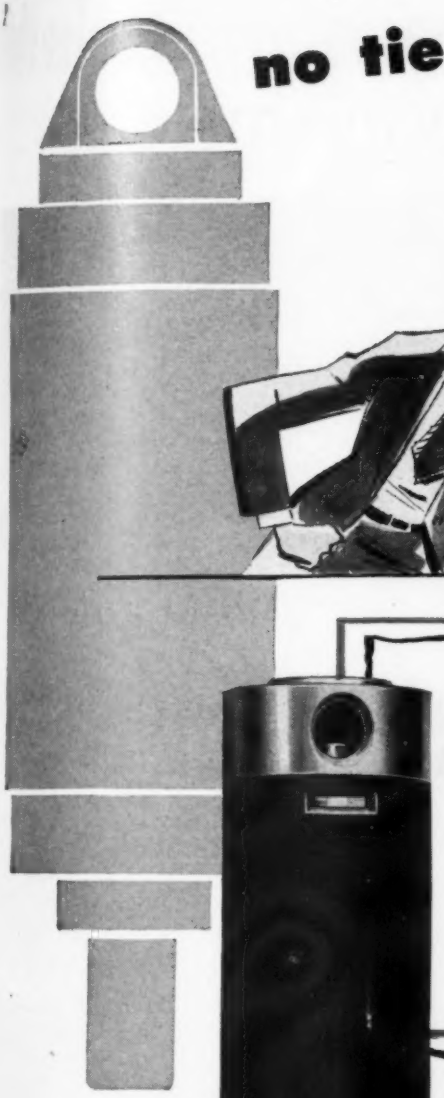
Charles F. Horne, Civil Aeronautics Administrator, is among those named to the Advisory Board for the second International Aviation Trade Show. Others recently named to the Board are M. S. Chapell, Kenneth S. Fletcher, Professor Gene Kropf, Edgar A. Lansing, Carl L. Stanke, Ansel E. Talbert, Donald Webster and A. R. Williams.

As consultants representing various branches of the aviation and aircraft field, the Advisory Board will formulate the programs to be held in conjunction with the show. These programs will present forums on technical and other subjects important to the industry.

In addition to government, Board members represent Dade Bros., Trans World Airlines, Parks College of Aeronautics, Esso Export Corp., the New York Herald Tribune and A. V. Roe, Canada Ltd.

The second International Aviation Trade Show, sponsored by Aircraft Trade Shows, Inc., will be held June 9, 10 and 11, 1953 at the Hotel Statler in New York City. It will present a display of representative air materials and services.

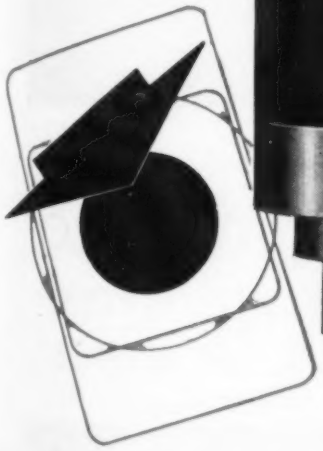
no tie rods...
no bulky end caps...



O-M air • hydraulic CYLINDERS

FIT where others won't!

In close quarters, an O-M Cylinder really shines because it is ALL CYLINDER! The *interlocking mechanism,* which does away with tie rods and projecting end caps, means that *more power is packed into less space.* Saves up to 1/3 installation space. Also provides perfect alignment, friction-free performance. Easier to install and repack. End plugs tapped for universal mounting . . . with a complete range of mounting brackets, interchangeable bore for bore. All machined steel, with bearing bronze (no castings)—easily turned down to fit in deep recesses of machines or bases. Available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. *Completely interchangeable parts.*



Send today for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

14-DAY DELIVERY ON MOST SIZES

mail coupon now!

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☐ Please send latest O-M Catalog
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the GEROTOR mechanism

because it's **PRECISION** engineered

In every GEROTOR pump or motor, precisely paired gear-shaped elements transmit power from or to the shaft with high efficiency. These elements, revolving in the same direction at low relative speed, constitute the GEROTOR mechanism . . . famed for longer life, less wear, less slippage, dependably smoother performance. With GEROTOR pumps or motors, hydraulic circuits "run like clockwork", too.

Gerotor May Corporation, Baltimore 3, Md.

GEROTOR

HYDRAULIC PUMPS & FLUID MOTORS

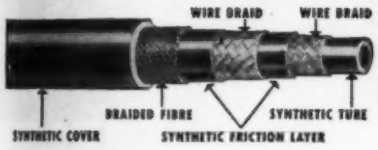
Make Economical "On-the-Spot" Repairs with

WEATHERHEAD

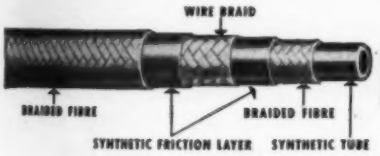
ALL-STEEL REUSABLE HOSE ENDS AND INDUSTRIAL HOSE

When men and machinery are idled by breakdowns in hydraulic lines, you lose time and money. Cut these losses to the bone by stocking Weatherhead All-Steel Reusable Hose Ends and Industrial Hose for "on-the-spot" repairs.

Weatherhead Hose Ends are precision made for fast, easy attachment and for perfect fit that insures leakproof connections. All-steel construction means you can use them again and again under rugged operating conditions. Weatherhead Hose meets every industrial need with a size range from ¼" to 2" I. D. for low, medium, medium-high and high pressure applications.



H-25 High-Pressure Hose, double wire braid reinforcement and tough, non-fraying synthetic cover for trouble-free service.



H-69 Medium High Pressure Hose, wire braid reinforcement; impregnated cotton cover that requires no stripping to attach ends.

plus three other synthetic covered types for low, medium and medium-high pressure uses

WRITE TODAY for Catalog H-1451 with details on hose ends and hose you can stock for "on-the-spot" repairs.

The Weatherhead Company, Dept. A, 300 East 131st St., Cleveland 8, Ohio.
In Canada: The Weatherhead Company of Canada, Ltd., St. Thomas, Ontario.

Weatherhead Industrial Warehouse Distributors in all principal cities

ATTENTION OIL SUPPLY HOUSES!

Here's another Weatherhead First! A "Show 'Em and Sell 'Em" unit that you can stock with bulk hose and fittings your customers regularly use. Get details and price data by writing today to Weatherhead Industrial Div., Cleveland 8, Ohio.

See Our Exhibit
OIL SHOW
TULSA MAY 14-23

The Mark of Quality
WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

GET SMOOTHER HYDRAULIC OPERATION

HERE'S HOW: Make your hydraulic medium *Texaco Regal Oil (R&O)*. Tests prove it has *more than ten times the oxidation resistance* of ordinary turbine-quality oil. It prevents sludge, rust, and foam. Hydraulic systems are bound to stay clean, hydraulic operation is bound to be smoother.

Ask the operator of any Texaco-lubricated hydraulic mechanism and he'll tell you: *Texaco Regal Oil (R&O)* is the world's best protection against unscheduled stoppages. It adds enormously to pump life . . . keeps maintenance costs low.

A Texaco Lubrication Engineer will gladly help you select — from the complete line of *Texaco Regal Oils (R&O)* — the one that will assure most efficient performance of your equipment, whatever its type or size. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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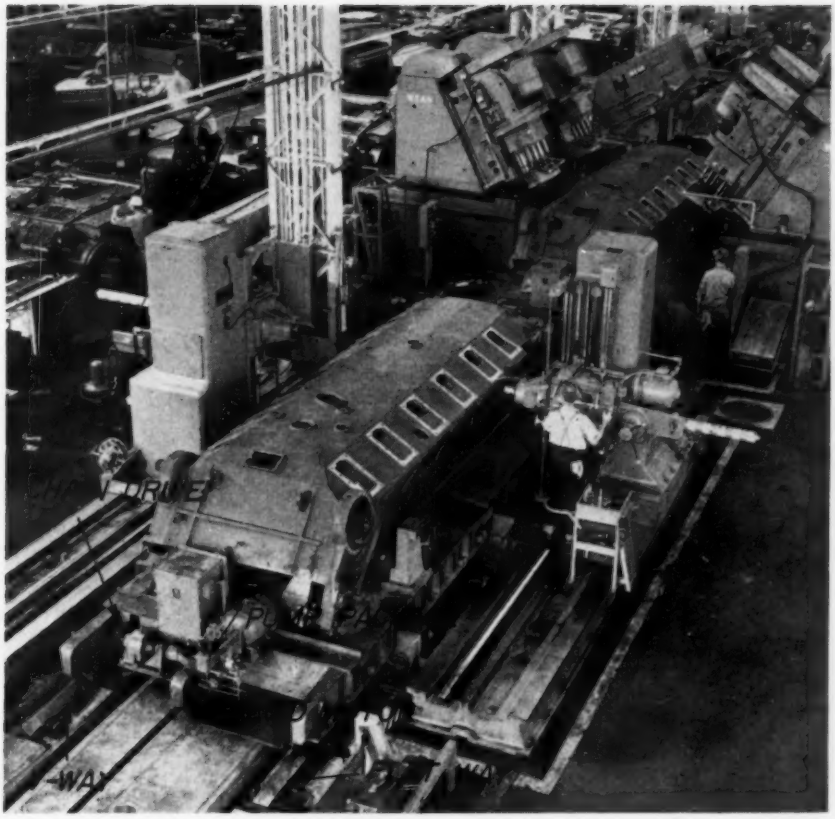
The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R & O)

FOR ALL HYDRAULIC UNITS

TUNE IN: Tuesday nights on television—the TEXACO STAR THEATER starring MILTON BERLE. See newspaper for time and station.



FOUR TON GUN carrier hulls move 150 feet through three main machining stations on hydraulically driven shuttle cars.

HYDRAULIC DRIVE for 13 ton work transfer car

By K. R. Keska

POWER supplied by a 5 horsepower d.c. motor driven hydraulic pump package propels a 13 ton fixture and its 4 ton workpiece through milling, drilling, reaming and tapping operations. The 13 ton holding fixture is a shuttle car complete with its drive unit and positioning cylinders which runs on tracks and takes its power from a third rail.

Built by Wean Equipment Corporation, the three station transfer machine being used at the Massey-Harris Co. plant in Racine, Wisconsin, machines the drive suspension pads on the hull of a new gun carrier. Five shuttle cars are supplied with the machine. While three are in use, one at each station, two are being loaded. The cars travel in a straight line for 150 feet between the load and unload positions. A crane removes the finished hull and also picks up the shuttle car and returns it to the load position at the head of the line.

Selection of hydraulic power to move the shuttle car was made because of weight and space requirements and also because oil power had to be available to locate the heavy fixture. Standing on a platform at the front of the car, the operator controls the movement of the car by operating a control valve on the power package which starts and stops the fluid motor.

The hydraulic power package, which includes an 8 gpm, 1000 psi pump, reservoir, relief valve and two manually controlled four-way valves, weighs only about 55 pounds without its gallon capacity of oil and has overall dimensions of approximately 12 x 8 x 12 inches. In neutral, the four-way valves are spring centered to block the cylinder ports and circulate oil be-

K. R. KESKA, Chief Staff Engineer, Wean Equipment Corp., Euclid, Ohio

tween the pump and reservoir. One control valve directs oil to the fluid motor which drives the car. The other valve controls the operation of the car's lift cylinders.

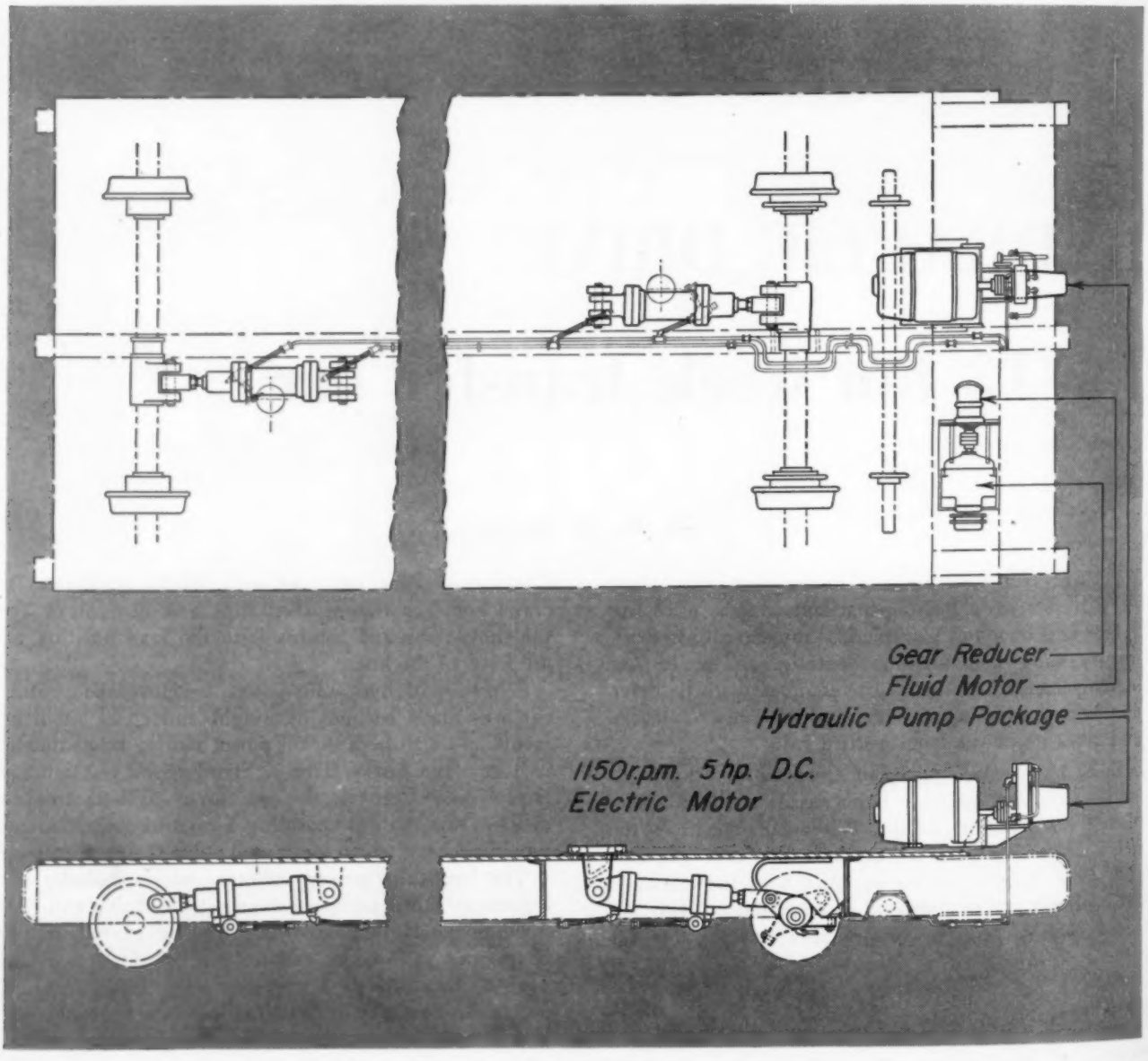
A driving torque of approximately 360 pound inches is developed by the piston type fluid motor when pump pressure is 1000 psi. At a flow rate of 8 gpm, the fluid motor rotates at about 750 rpm. The fluid motor shaft drives a gear reducer which drives the car through a chain drive moving the car at a rate of 762 inches per minute.

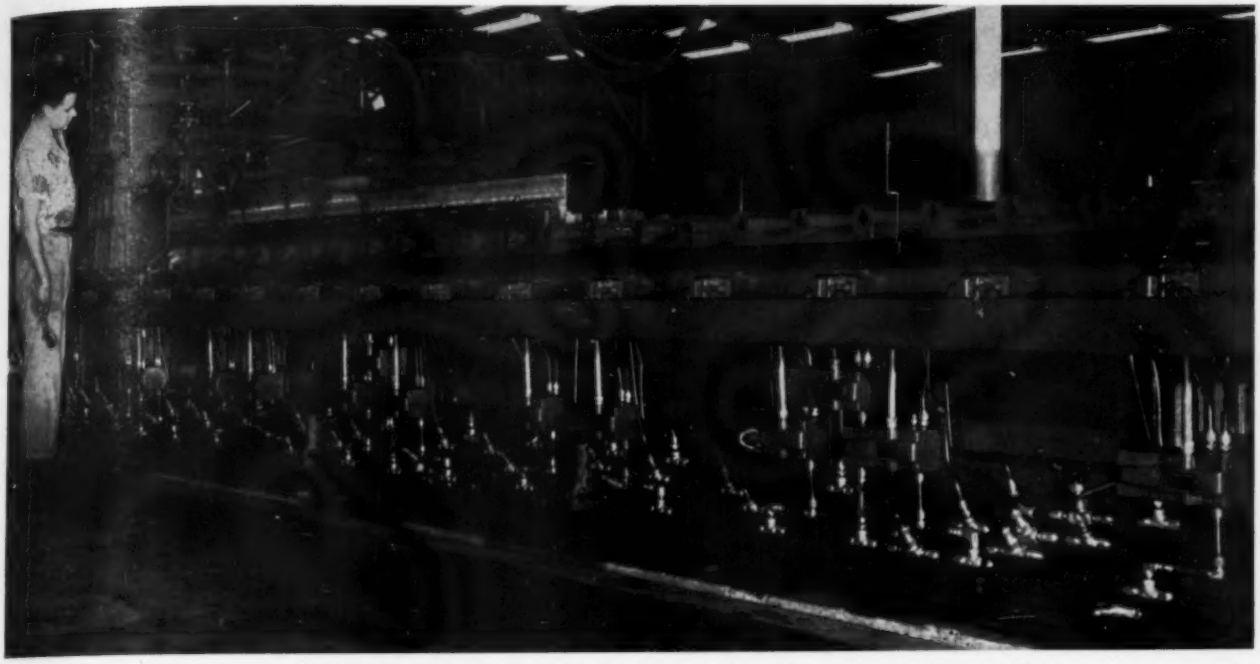
Indexing of the shuttle car is visually controlled by the operator. He can bring the car to a stop within a fraction of an inch of an index mark. With the car stopped, movement of one control valve retracts the wheels of the car to lower the car onto a V and flat way. Hydraulically powered tapered plungers on each side of the machine then are advanced to locate the car accurately and clamp it during machining.

Raising and lowering of the car wheels is done with two clevis mounted 5 inch bore 11 inch stroke cylinders. Each cylinder is mounted near the center of an axle. The cylinders are connected in parallel and take pressure oil from the shuttle car's drive pump. Each cylinder actuates an eccentric lever through an arc of 129 degrees to vertically move the entire car a distance of approximately ¾ inch.

Accurate indexing and controlled traversing of this 4 ton workpiece has been accomplished with a small compact hydraulic package.

HAVING OVERALL dimensions of approximately 8½ by 20 feet, the 13 ton shuttle car carries its drive unit on the front end. Power for the d.c. motor is taken from a third center rail. Hydraulic cylinders, mounted at each axle, actuate an eccentric to raise the wheels and lower the fixture onto a V and flat way to position the work during machining. The hydraulic package for driving the wheels through a fluid motor, gear reducer and chain drive provides a compact easily controlled power source.





CLAMP CYLINDERS ARE controlled by these solenoid operated valves which are arranged along the side of the bed on this automatic contour milling machine.

MULTIPLE CLAMP CIRCUITS simplify retooling on spar mills

PROPERLY supporting and clamping long airframe spar chords and longerons while milling requires many clamps and a device which will swing the clamps out of the cutter path.

On contour milling machines in the Dallas shops of Temco Aircraft Corporation, hydraulically powered clamping circuits have been designed to handle all types of air frame spars. These long machines have fixture bases 144 inches long and 24 inches wide on which the workholders and profile templates are mounted.

Due to the larger cross section parts requiring milled contours and the alloys from which they are made, it has been necessary to provide hydraulic power for clamping parts securely. Both horizontal pinch clamps and vertical hold down clamps are used. From the hydraulic pump and fixture along the operator's side of the spar mill, the complete hydraulic piping system as well as the necessary electric equipment is installed. All piping is completed with direct lines from the pump and return lines through a heat exchanger for properly cooling the oil used by the hydraulic cylinders. In effect, there is a manifold system that brings the outlets through the machine approximately 18 inches from the clamping units. The steel tubing, or hydraulic hose with which the clamps are equipped, makes it very simple to remove the clamp for fixture changing.

Hydraulic pressure may be varied from 50 psi to 1750 psi to change clamping force as required by different cross-sections of the work.

All safety measures have been taken into considera-

Have you ever hit a fixture clamp with a milling cutter? Where pinch clamps won't work and hold down clamps are in the cutter path, the "swing away" clamp system described in this article might be the answer.

tion. Piping and valve equipment have been furnished oversize and over the maximum working pressures incorporated in the clamping units and the output of the pump. Armored hose is used from the clamping units to the hydraulic piping wherever there is movement which could cause a wearing action. Steel tubing is used at all other places where movement is not a principle factor.

In designing the three basic hydraulic clamping units, the designer had to contend with many obstacles. Heretofore it has been the common practice to provide individual clamping for every basic milling operation. Several or a variety of vertical clamps were employed as well as a variety of horizontal clamps. This was definitely detrimental because new designs of clamps were required whenever the size and shape of the parts increased or decreased. Three basic clamping units have been provided on the new clamp circuits:

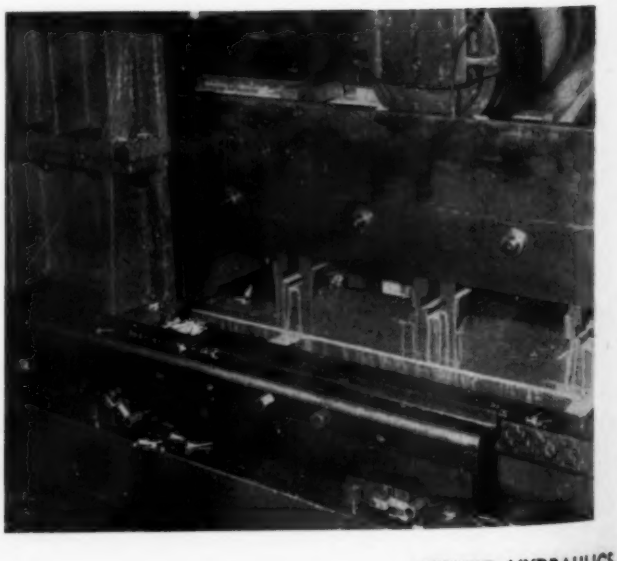
1. Double-acting vertical clamping can be used for straight vertical movement and provision is made for operating the clamp on an automatic principle that turns the clamp jaw 90 degrees away from the cutter. This sometimes is necessary due to the milling operations required where clamping pressure must be provided directly ahead of the cutter and again directly after the cutter passes the clamping unit.
2. Single side clamping is provided by the use

Concluded on page 118

SOME MILLING operations require clamping pressure directly ahead of the cutter and again directly after the cutter passes. In the photo at the right, the cutter is approaching the clamp. The cam rail at the lower left foreground approaches the limit switch.

WHEN THE CAM trips the limit switch, a solenoid valve shifts to direct oil pressure to release the clamp, as seen in the photo at bottom. As the clamp rises it pivots 90 degrees to be clear of the cutter.

CLAMP, in bottom right photo, has returned to holding position after the cutter has passed. Cam, shown in lower portion of photo has released the limit switch to cause the clamp to resume its original position.



To help you get the best from your oil powered machines, here are

Prescriptions For Oil For Hydraulic Systems

By Bruce M. Dunham

SOME hydraulic systems, like some human bodies, are well fed and well cared for; similarly others are poorly fed, neglected, abused and badly maintained. The result is much the same in both the hydraulic and human cases—"sick" below par performance and a shorter than normal life expectancy.

Hydraulic oils, as the life blood of hydraulic systems, must be produced to contain properties and special abilities that will permit system components and the system as an entity to perform their designed functions to best advantage. The basic specifications of hydraulic oils, listed in Table 1, are essential. Any less properties or abilities results in an oil that is unbalanced or unsuited for selection in a hydraulic system.

The requirements of all types and conditions of hydraulic systems necessitate different specific abilities in an oil that will do best under a given group of conditions. Individual oils may be chosen to suit specific operating conditions. Such oils may be grouped as indicated in Table 2.

The variables in column 2 are based on the amount of leakage and the type and amount of contamination in the system. Types of oils recommended in column 3 are based not only on performance from the standpoint of minimizing service difficulties and offering adequate protection to vital working parts, but also to provide the greatest overall economy.

Table 1
Basic Specifications of Hydraulic Oils

1. Sufficient fluidity to adequately transmit power under the conditions of the operating system.
2. Proper viscosity and lubricity to lubricate all moving parts and reduce wear to the minimum.
3. Ability to supply a seal for all moving parts over the entire operating temperature range.
4. Adequate viscosity index to provide a minimum change in rate of flow over the temperature operating range.
5. Sufficient stability to resist oxidation breakdown and maintain original characteristics.
6. Ability to protect metallic parts against rust and corrosion.

For example, take the conditions of items 1 and 2 in which very little leakage is encountered, so that only small quantities of make-up oil are required. In such cases, it is much more economical to utilize the relatively higher priced inhibited turbine quality oils because they will not have to be replaced nearly as often as straight mineral oils and, in addition, give much better protection to the system. If, on the other

BRUCE M. DUNHAM, Technical Consultant for the Sun Oil Company, Philadelphia, Pennsylvania.

Table 2 Most Suitable Type Oils for Hydraulic Systems

Type of System	Condition of System	Most Suitable Hydraulic Oil
1. New Unit	Tight system; little or no make-up oil added	Highest grade, well refined, oxidation and corrosion inhibited oil
2. Old Unit	Tight system; very small amount of make-up oil added	Highest grade, well refined, oxidation and corrosion inhibited oil
3. Old Unit	Medium leakage; average rate of make-up oil added (5 percent per month)	Good grade of refined paraffinic or naphthenic straight mineral oil
4. Old Unit	Excessive leakage; high rate of make-up oil (above 10 percent per month)	Straight mineral or oxidation inhibited oil compounded with additives to reduce leakage
5. New or Old Unit	Excessive contamination from cutting fluids or other type extrinsic contaminants	Straight distilled mineral oil *Note*: system should contain a suitable filter and oil changed frequently
6. New or Old Unit	System so designed that hydraulic oil also lubricates ways	Well refined mineral oil compounded with special additives designed to eliminate stick-slip of ways
7. New or Old Unit	Some continual contamination from extrinsic contaminants such as dust, paper fly, etc.	Detergent-dispersant type mineral oil
8. Comparatively New or Old Unit	Comparatively tight system with build-up of contaminants, both extrinsic and from oil breakdown	Clean out system with special cleaner oil; refill with highest grade, oxidation and corrosion inhibited mineral oil

. . . to select a hydraulic oil, know the condition of your machine . . . amount of leakage and contamination

hand, an operating system leaks badly and large quantities of make-up oil are required, a relatively low cost straight mineral oil will afford the better economy.

Some petroleum suppliers have perfected oils containing additives specifically intended to reduce leakage quite substantially (30 to 50 percent) and at the same time maintain the proper viscosity suitable to various systems to keep the highest possible overall efficiency. The use of such oils in "leakers" has provided the means for substantial monetary savings, and at the same time, improved housekeeping conditions in the plant.

In some machines, designers have combined lubricating and hydraulic systems, as in item 5 of Table 2. Such a system may utilize a hydraulic oil to lubricate the ways or a lubricating oil may be used for an auxiliary, light service hydraulic circuit. In such cases the equipment designer familiar with the characteristics of the oils available, usually recommends a specific type of fluid for use.

In some machine tools or industrial production machines the cutting fluid may continually contaminate the hydraulic oil, as in conditions given for item 6 of Table 2. In such a case, it is more economical to use a low cost straight mineral oil and change often enough to guarantee satisfactory operation. Some cutting oils are corrosive and can cause considerable damage to the hydraulic system. Emulsifiable cutting oils contain large quantities of water and it is dangerous to operate a hydraulic system which contains over one percent water in the oil. Where excessive leakage of cutting fluids into the hydraulic system is present, necessary modifications to eliminate this condition should be made.

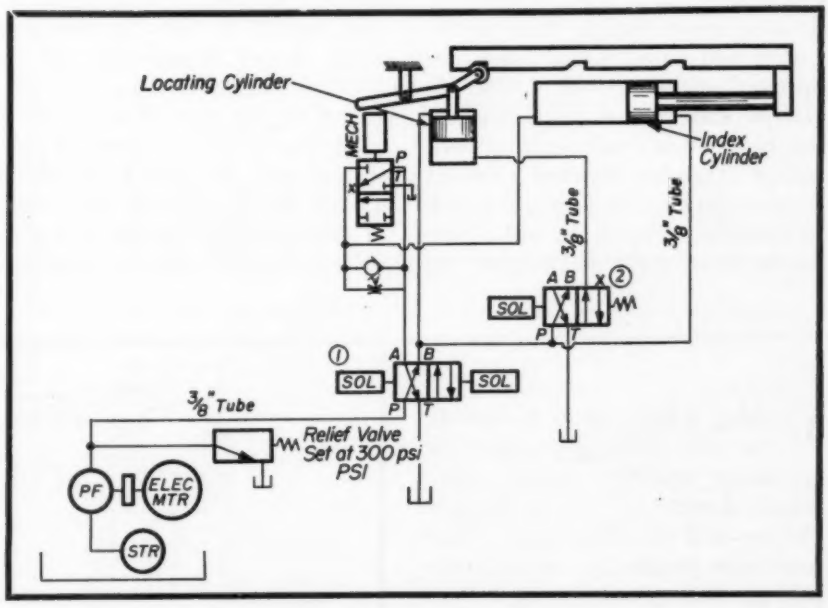
In a hydraulic system which is continually contaminated (item 7 of Table 2) by dust, process material, paper fly, etc., the most effective hydraulic oil would be one with detergent-dispersant characteristics. Such oils do not allow the contaminants to settle out, but rather disperse them into fine particles and carry them on to a filter for removal, keeping the system clean during operation.

The selection of a hydraulic oil depends upon individual operating conditions. Careful analysis of average operating conditions with respect to amount of leakage and the type and amount of contamination is paramount for satisfactory service and economy.

Hydraulic Indexing Circuits
for machine tools

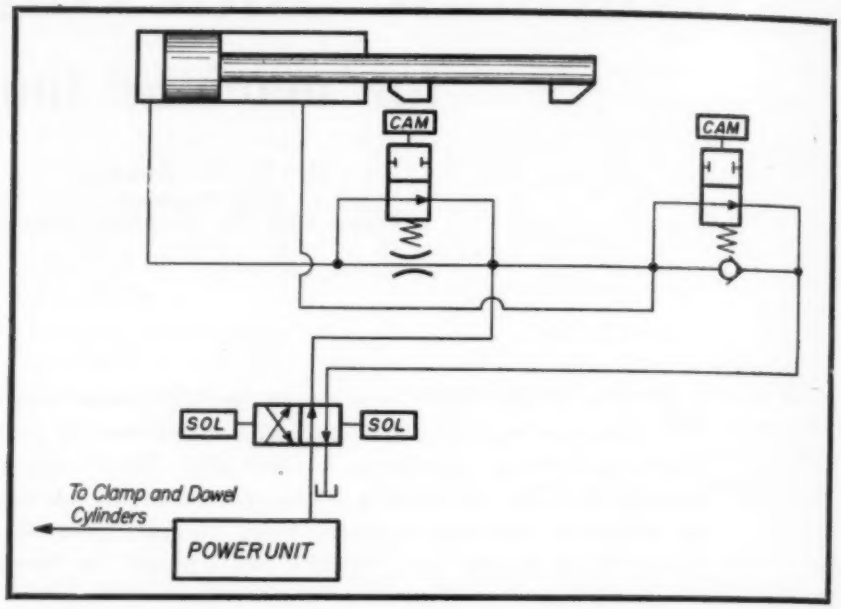
By E. Y. Seborg
Chief Engineer
Barnes Drill Co., Rockford, Illinois

MULTI-OPERATION machinery include some means of indexing the work between stations. The designer can select from many hydraulic circuits which have been operating successfully. These circuits will often have to be tailored to meet the cycling requirements of the particular job. Shown here are six different indexing circuits. Four circuits present methods for indexing a rotary work table; two circuits are applied to linear transfer mechanisms.



1. This multiposition lateral index circuit lends itself to automatic operation in indexing a part with several operating positions under a single spindle. It was used on a single spindle honing machine which honed a multicylinder engine block. Table direction 4-way valve (1) is set up by operator energizing the solenoid when part is loaded and clamped to moving table. Oil is directed to rod end of index cylinder and to top of locator cylinder. It is also directed to bottom of locator cylinder through spring offset 4-way valve (2). Table moves to left until roller enters first operating position slot. As roller enters slot, mechanically operated 4-way valve closes directing oil from discharge of index cylinder through throttle orifice causing deceleration. When table contacts roller for accurate position, a limit switch, operated by locating surface, causes the table to be clamped, which in turn starts the machine cycle. Completion of machine cycle energizes solenoid for unclamping and energizes the solenoid of spring offset 4-way valve to release pressure on bottom of locating cylinder and cause the locator to drop down and the table to move to next position. After last position, part is indexed to unloading position on left or can be automatically returned to loading position at right, by operation of valve (1). In this circuit, accuracy is assured by holding pressure against stop in same direction during operations. Index itself is very fast, because there is little lost time in pulling locator and no lost time in putting it in.

Indexing Circuits



2. Speed of operation is essential on this typical transfer, locating and clamping circuit. The time required for unclamping, retracting dowels, transfer, resetting dowels and clamping is non-productive time, and the transfer is usually quite long, depending on work piece and size of working units. The circuit uses a combination of two vane pumps to give a lot of oil when required and a small amount to hold pressure during work cycle. Clamp and dowel 4-way valves are operated simultaneously, releasing clamps and retracting dowels. At this time, oil is available from both pumps. Transfer forward solenoid is then energized and oil is directed to transfer cylinder. In order that acceleration and deceleration of transfer be smooth, special acceleration and deceleration valves are used. The rate of transfer at full speed is around 15 inches per second, which is fast for the mass being moved. In one case, 22 automobile cylinder blocks were moved at this rate. When index is complete, "dowel in" solenoid is energized and the part is located in fixture. We use flow dividing valves in the dowel pin circuit to keep a uniform travel rate, so that one dowel doesn't go home like a bullet and spoil the locating hole in the part. The clamp 4-way valve is next operated, and parts are clamped. Oil is then made available to return the transfer bar. When transfer bar is back, pressure builds up and unloads large pump to tank.

The article is adapted from the paper Mr. Seborg presented at the eighth National Conference on Industrial Hydraulics held in September 1952.

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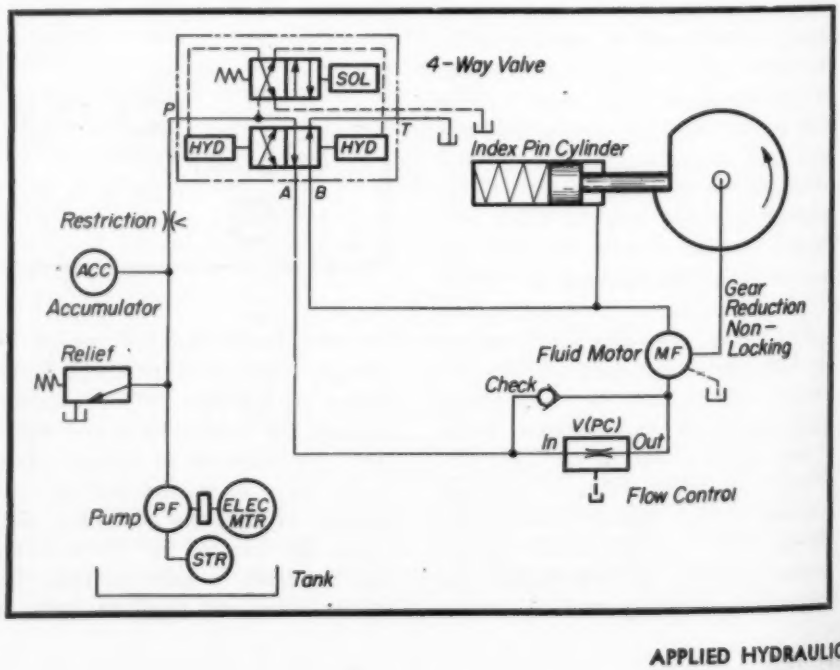
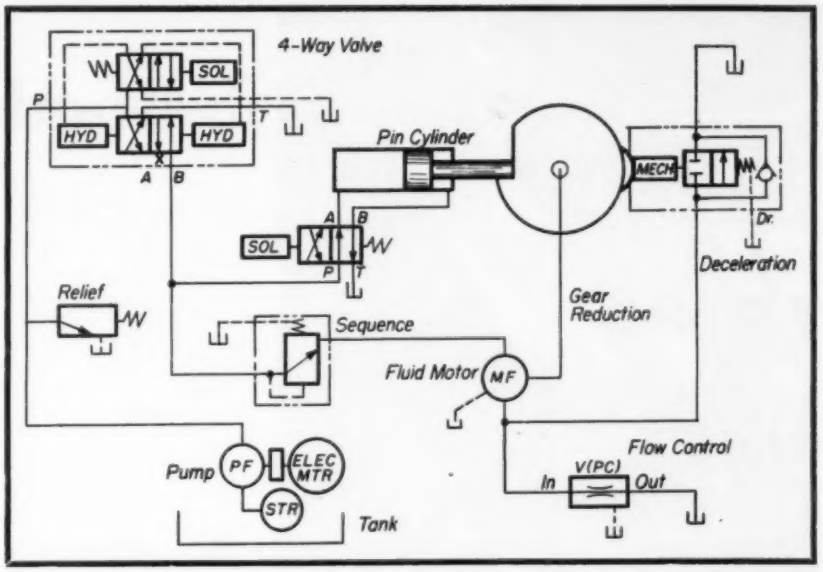
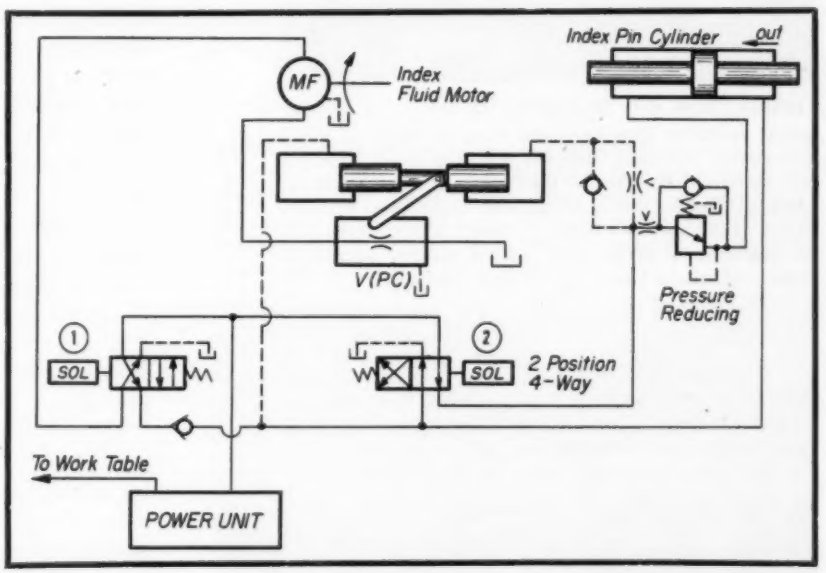
3. Using a fluid motor to operate the table, index is initiated by operating solenoid 4-way valve which directs oil to withdraw plunger and run fluid motor. After next index position is reached, solenoid is deenergized, spring locates plunger and motor is reversed at controlled rate of travel, until plunger is contacted. Pressure is maintained against stop during working cycle. The accumulator makes it possible to store up oil under pressure during working cycle for use during index, giving rapid index with a small capacity pump.



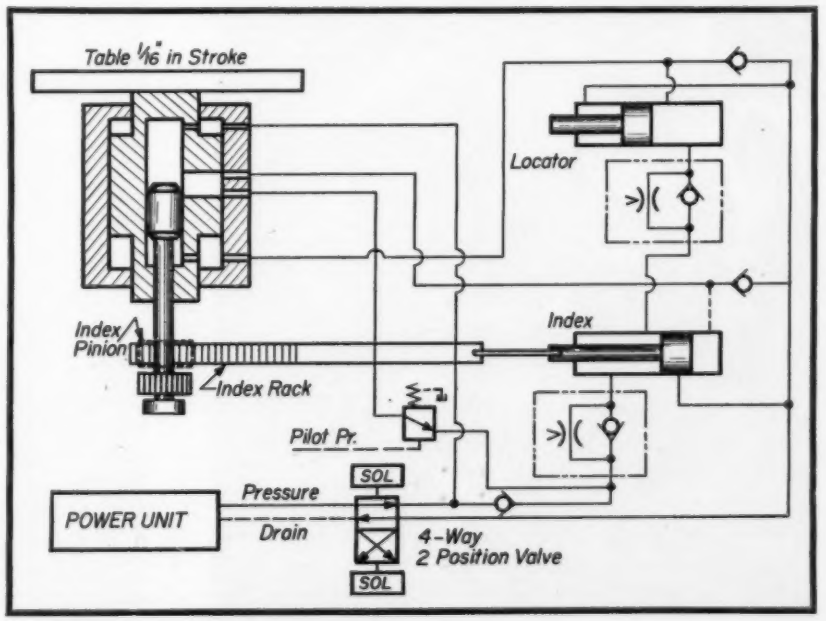
4. A fluid motor for this index revolves in one direction. When index solenoid and locating pin solenoid are energized, oil pulls pin and then builds up pressure through a sequence valve to operate the fluid motor. As long as cam holds valve closed, speed of index is controlled by volume control valve. This gives both acceleration and deceleration control to the table. When table is in approximate position, pin solenoid is released, causing oil to extend locating pin into position.



5. A large work table is used on this machine. Here a volume control valve is varied to give control of deceleration. Table is lifted by energizing its valve solenoid. Index is initiated by energizing valves (1) and (2). Four-way valve (2) directs oil to withdraw index pin and move volume control to high speed. Four-way valve (1) directs oil to rotate fluid motor. Before next index position is reached (2) is deenergized directing oil to shift volume control to slow speed and locate index plunger. The table is then clamped.



6. Designed by Barnes Drill, this index circuit uses the porting of cylinders to obtain interlocking of different motions, thus eliminating control and solenoid valves. Only one 4-way valve is required. When index solenoid is energized oil is directed to withdraw locator. As this piston travels back, it uncovers a port directing oil to the bottom of the lift cylinder. This cylinder has a piston within a piston. The table must be lifted and index gear engaged before oil can flow to back of index cylinder to index the table. Deceleration is accomplished by regulating flow of oil at the end of stroke. When index is complete, oil is directed to back of locating plunger which has a larger area then the rod end and thus causes plunger to locate table. At this time a limit switch is operated reversing 4-way valve, directing oil to clamp table, disengage index gear and return index rack.



Goodrich Aims For Ce

OPERATION OF EQUIPMENT in the Goodrich plant requires five pressure ranges. Four of these pressures: 250 psi, 500 psi, 1500 psi and 2000 psi are supplied by pumps located in a central power station. These clearly identified main lines coming from the power house carry water pressure throughout a plant area which covers about 51 acres. All main lines use welded fittings.

INSTALLED IN 1949, this dual suction, electrically driven centrifugal pump supplies 250 psi water. Having a capacity of 3000 gpm at 1750 rpm, this pump normally supplies enough volume for all plant facilities which require 250 psi.

ONE of the modernization programs being carried out by the B. F. Goodrich Company in Akron will result in centralizing all the hydraulic pumping units in the power house. Latest models of electrically driven units will replace steam driven pumps. Spread out over an area of about 51 acres, the Goodrich plant includes four divisions: tire, industrial and general, aeronautical, and processing. Each of these divisions has equipment requiring water pressure for its operations.

Closing pressure on many tire curing presses is supplied by water power. The large curing presses are individually powered by oil hydraulic pumps to give the required control. Presses for making belts, matting and other mechanical molded products use water hydraulics as do the hose testing machines and fitting presses.

Like many of our large industries, rubber products producers have had plants in operation on one site for more than a half a century. During these years, these plants have been expanded to meet growing demands. Often, the lack of money, time or the uncertainty of requirements necessitated following the rule of "making the best with what you have". Additional equipment was added, old equipment was revamped, but seldom was it possible to clear out a plant or a large section of a plant and start from scratch. Although modern, more efficient equipment was being developed, these plants had an investment in older equipment which still had many servicable years.

Install Triplex Variable Volume Pump

The many different operations throughout the plant require separate pressure sources for 250 psi, 500 psi, 1000 psi, 1500 psi and 2000 psi. Low pressure 250 psi and 500 psi installations were originally located in the power house 33 years ago. As machines requiring higher pressures were installed, pumps were located near the machine rather than in the power house. For a few machines, this arrangement is necessary because the cost of establishing long lines would be prohibitive. However, as the plant facilities grew, it was found that pumps were scattered throughout the plant, making maintenance difficult and interferring with efficient

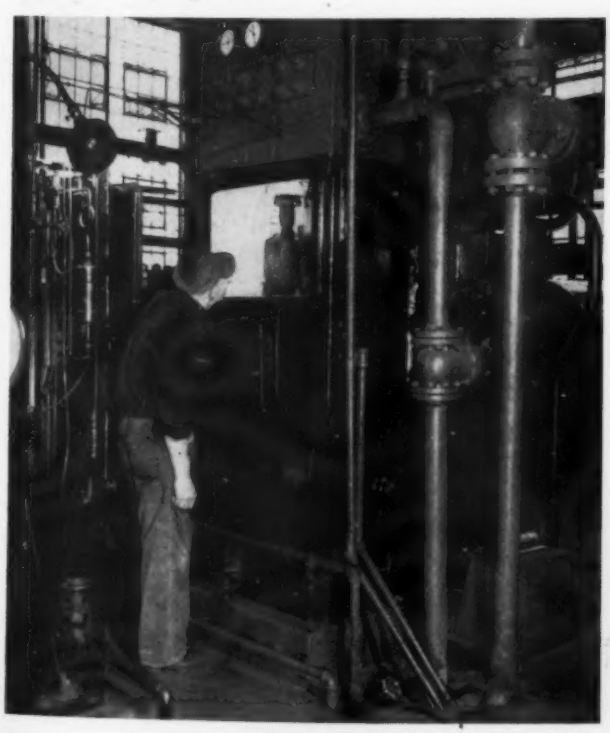
For Centralization of Hydraulic Power to reduce maintenance costs

plant layout. Today four pressure systems originate in the power house. Only the 1000 psi system is left to be brought in from the shop and the 1500 psi system is still to be completely centralized.

The latest addition to the central pump station is a triplex variable volume 1500 psi pump. It is planned to add fixed displacement units for this pressure to handle the minimum loads and then use the variable pump to fill out the demand. This arrangement will provide the most efficient pumping facility in the plant having an accurate volume regulation to meet the demand.

Locating lines to run throughout buildings which have been in use for many years is a layout problem requiring careful planning. Size ranges of piping is 2½ inch diameter for the 1500 and 2000 psi system, 6 inch for the 500 psi and 8 inch for the 250 psi.

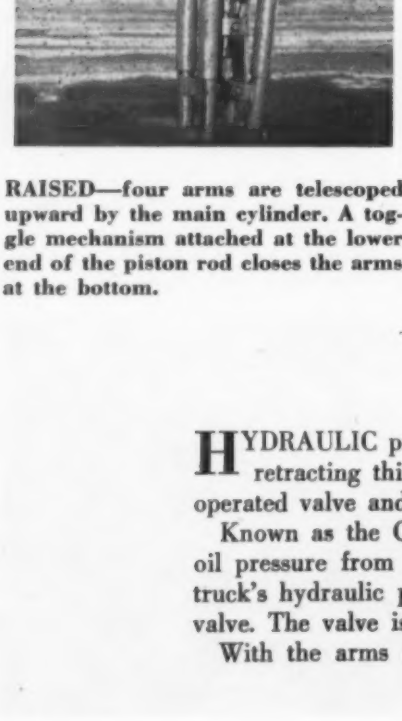
UP UNTIL 1951 all machines requiring 1500 psi were supplied by pumps located in the shop. Today, a variable volume triplex pump which will deliver 100 gpm at full stroke is installed in the power house to supply the 1500 psi requirements. Plans call for complete removal of the two old steam driven 1500 psi pumps located out in the plant.



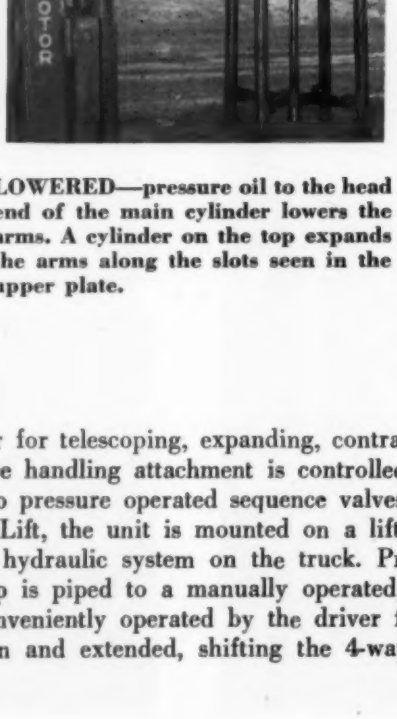
THIS STEAM DRIVEN duplex pump is typical of the type of pumping equipment which has been used for more than 30 years. These large cylinders, driven at 60 rpm, deliver 1500 gpm. Further modernization will replace these pumps with more efficient electrically driven units.

AMONG THE MANY hydraulically powered machines used at Goodrich is this giant belt press. The four different pressures are piped to the manifold on this press. Valving and controls are arranged to select the pressure range required by the particular work load.

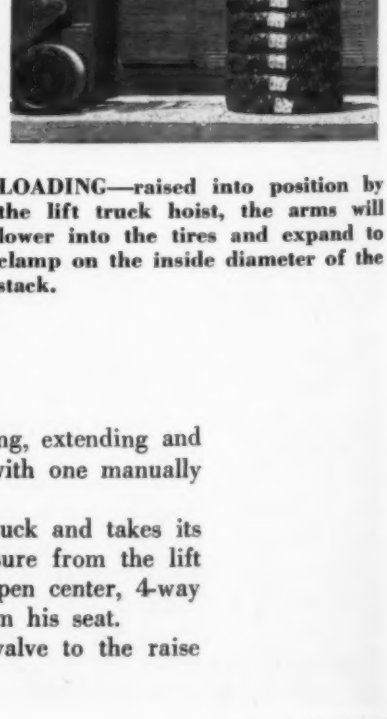
SEQUENCE VALVES CONTROL MULTIPLE MOTIONS



RAISED—four arms are telescoped upward by the main cylinder. A toggle mechanism attached at the lower end of the piston rod closes the arms at the bottom.



LOWERED—pressure oil to the head end of the main cylinder lowers the arms. A cylinder on the top expands the arms along the slots seen in the upper plate.



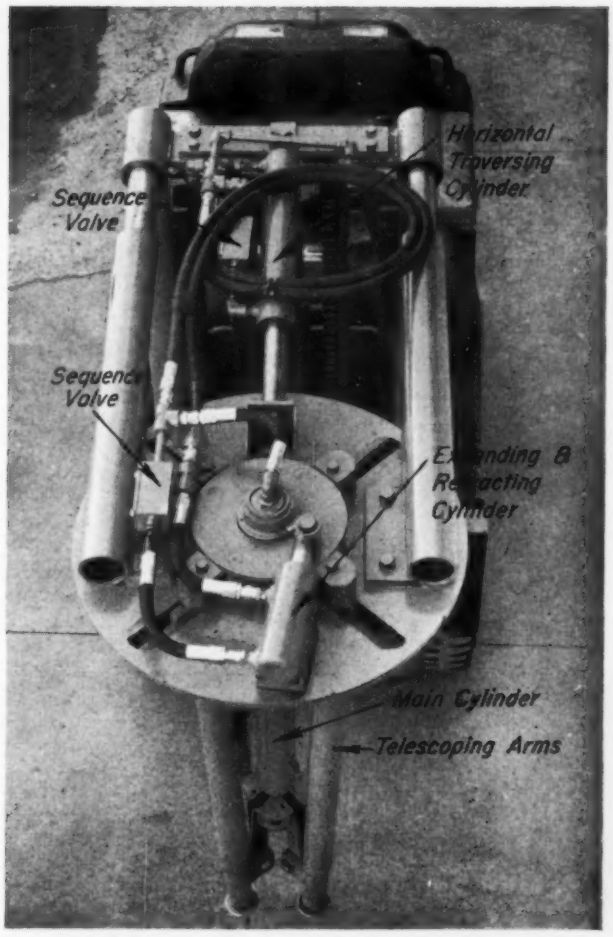
LOADING—raised into position by the lift truck hoist, the arms will lower into the tires and expand to clamp on the inside diameter of the stack.

HYDRAULIC power for telescoping, expanding, contracting, extending and retracting this tire handling attachment is controlled with one manually operated valve and two pressure operated sequence valves.

Known as the Core-Lift, the unit is mounted on a lift truck and takes its oil pressure from the hydraulic system on the truck. Pressure from the lift truck's hydraulic pump is piped to a manually operated, open center, 4-way valve. The valve is conveniently operated by the driver from his seat.

With the arms down and extended, shifting the 4-way valve to the raise

THREE CYLINDERS, which are controlled by an open center, 4-way valve and two sequence valves, are an integral part of this tire handling attachment. Movement of the 4-way valve, by the operator in his seat on the lift truck, operates the unit.



. . . two specially designed compact two-way valves are set to operate at any desired pressure with pressure oil flowing in either direction

position directs oil pressure to the rod end of the main cylinder. As the main cylinder raises, the arms telescope upward and are brought together at the bottom by the closing action of the pivoted spider arms attached to the bottom end of the piston rod. This operation requires about 200 psi. With the arms completely up, holding the 4-way valve open will cause oil pressure to increase and open a sequence valve to direct oil to the small retracting cylinder on the top of the unit. If the operator wishes to reach out for a load, he continues to hold the valve open and at 750 psi the second sequence valve opens and the entire unit moves horizontally away from the machine.

The operator is then ready to drop the arms into the stack of tires. After getting into position, he reverses the movement of the hand valve. Oil to the head end of the main cylinder causes the fingers to telescope down to their full length and open out to the load. At 500 psi, one sequence valve opens and the small cylinder spreads the arms at the top. If the load is not to be shifted near the machine, the operation stops here. However, if the operator wants the unit close to the lift truck, he continues to hold the 4-way valve in the same direction and at 1200 psi the second sequence valve opens and retracts the horizontal traversing cylinder.

Operation for unloading the tires from the arms is the same as for loading.

To keep the unit compact and with as few lines as possible, special sequence valves were built. Each of the two sequence valves shown in the photographs actually houses two valves so that the valve is pressure operated in both directions of oil flow.

The telescoping vertical arms can be extended to pick up an entire stack of tires or to lift only a few from the top of the stack. In one plant where this method of handling is now in use, a tire stacking job which formerly required 7½ hours is now done in less than two hours. Approaching this handling problem from the inside diameter rather than the outside, utilizes storage space to the maximum. Designs are underway using the same principle for handling rolled wire, coils of tubing, coiled steel rod, and other coiled stock.

DESIGNED to SAVE AIR

Air can be a large operating cost. Installation of simple valves to cut off non-working cylinders results in reduced power charges.

TWENTY-SEVEN AIR CYLINDERS power the clamps on this 40 foot plate planer. They can be worked in groups or all together depending on the plate length.

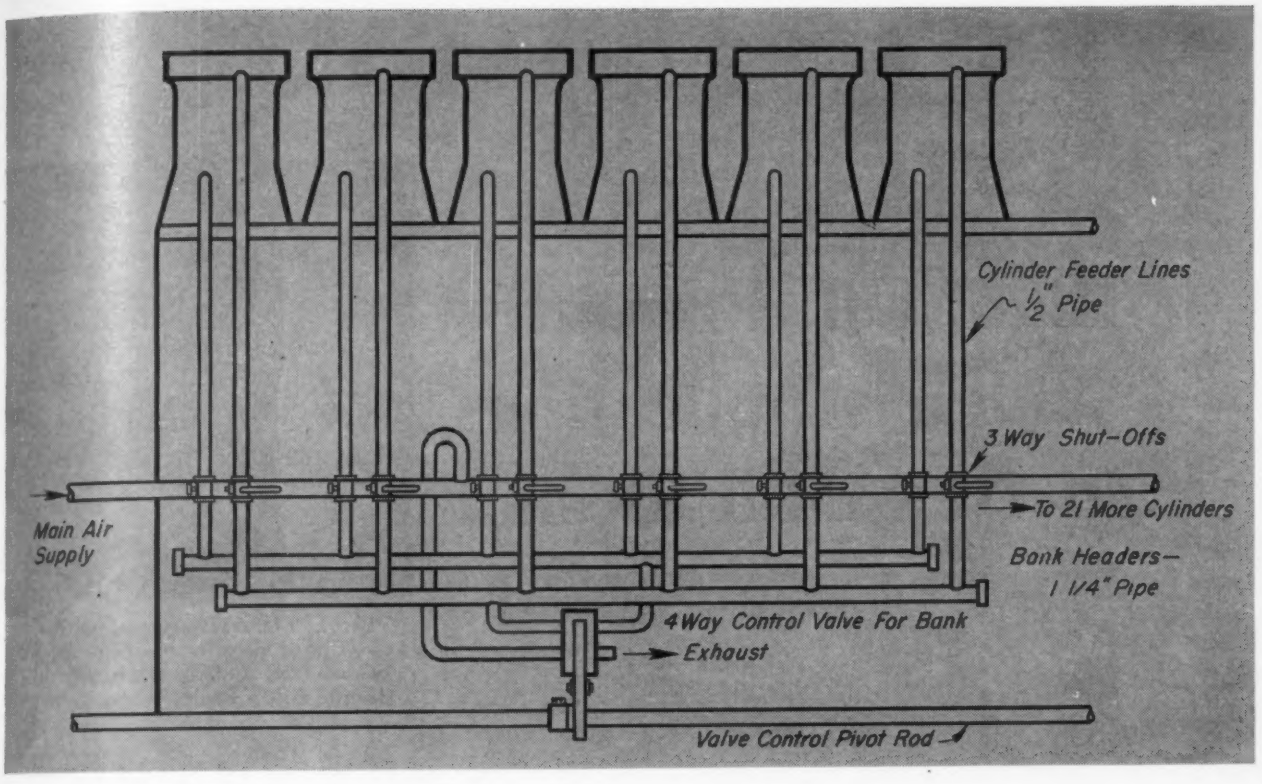
IT is a well recognized fact that air is a rather expensive necessity in a shop and that everything possible should be done to economize on its use. With this idea in mind, the 27 air operated clamping cylinders on the 40 foot open-throat planer, installed by Wyatt Metal and Boiler Works in Houston, Texas, have been arranged in banks so that only those cylinders which are directly over the plate are operated. Even individual cylinders can be cut out.

Built by Baldwin-Lima-Hamilton Corporation, the press uses five banks of cylinders. A bank of six cylinders is at each end and three banks, each having five cylinders, are in the middle. Cylinders are equally spaced on 18 inch centers. Each cylinder is 12 inches in diameter and has an 8 inch stroke to provide ample clearance for loading and unloading the work. These double acting cylinders are packed with double cup leathers and each cylinder exerts a clamping force of approximately 10,000 pounds.

A 1¼ inch supply line extends along the machine the full distance occupied by the cylinders. At the inlet end it is equipped with a separator for removal of water entrained in the air, and a pressure switch, the purpose of which is to stop the main motor in the event of low pressure or air failure. There is also a lubricator installed on this line and a pressure gauge located on the planer housing.

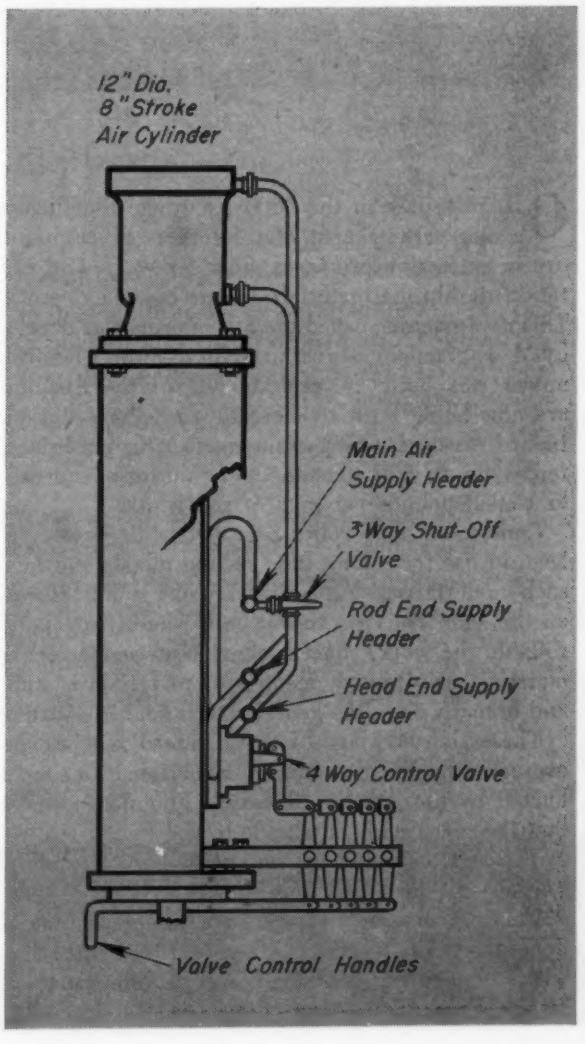
Each bank has two headers. One supplies the head end of the cylinder; the other supplies the rod end. Each bank header is connected to the supply line through a 1 inch self locking type, 4-way air valve. The valve is manually operated by a lever attached to the valve and another lever attached to a handle. These levers are mounted on shafts which extend along the lower back side of the beam. Operating handles for each bank are located at both ends of the planer near the housings and within easy reach of the operator.

Operation of any of the three position, 4-way valves, by moving one of the levers grouped at the ends of



ONE OF THE FIVE BANKS of clamp cylinders is shown here. The main supply pipe runs the full length of the planer to supply 90 psi air pressure to all 27 cylinders. Each bank takes air from its bank headers. Direction of clamp travel is controlled by a three position, 4-way valve. There is one valve for each bank. A water separator and lubricator unit are placed at the main air supply inlet. A pressure switch in this line will stop the planer drive if clamp pressure falls below a safe value.

SIDE ELEVATION shows the pipe lines which run behind the planer housing. A mechanical linkage to each of the five control valves on the planer is arranged to permit valve control from either end of the planer.



the planer, controls the cylinder banks. To cut off individual cylinders in any bank, 3-way valves are installed in the ½ inch pipe lines which connect the headers to the cylinders. When a cylinder is operating, the 3-way valve in the line to the top side of the cylinder is connected so the air flows from the header to the cylinder; the exhaust port of the valve is blocked. At this time, the 3-way valve in the line to the bottom of the cylinder carries air flow from the cylinder to its header which is open to exhaust through the 4-way valve. Shifting a 4-way valve to neutral cuts out its entire bank. Shifting the two 3-way valves in each cylinder circuit, cuts out the individual cylinder. In the cut off position, the head end of the cylinder is open to exhaust and the rod end is open to the main supply pipe. This prevents the clamp from drifting down while the planer is in operation.

High Oil Pressures Widen Applications in New Mill Design

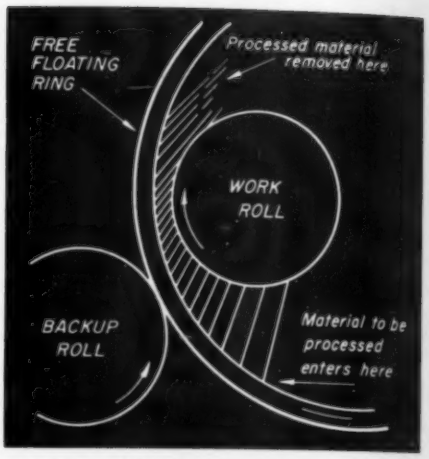


FIG. 1. FLOATING ring between two opposing rolls resists plugging of material and allows higher hydraulic roll pressures.

OIL pressures in the 3000 psi range together with a new arrangement of rolls offers great possibilities in extraction processes, fiber recovery, and preparation of fibrous materials for processing operations. This new machine called the Stacomizer, was developed by M. J. Stacom and just prior to the war a laboratory model was built. Several models of the Stacomizer are now being built by Farrel-Birmingham Company, Inc. of Ansonia, Connecticut in sizes having hydraulic forces up to 500 tons to apply uniform squeeze up to 15,000 pounds per inch of roll width.

Continuous feed roller type hydraulic presses have been in use for a long time rolling metals and mixing such materials as rubber and paper pulp. However, on the standard type rolling mill where two opposing rolls do the work, squeeze pressures on relatively soft materials are limited, feeding of materials is difficult and in many cases the generation of heat is destructive.

These shortcomings of the standard mill are being overcome by the Stacomizer. Experiments being conducted by the Armour Research Foundation indicate that the machine is adaptable to processing many materials and that the application of high pressures has unusual effects on the materials processed.

Pressure loading of rolls with oil power has been done for many years. It's one of those applications where the selection of oil power is unquestioned. A large force is needed and fluid power can supply the force efficiently through relatively simple and compact machine members.

If it is so easy to develop high pressures with hydraulics, why not step up the loading between conventional rolls if the materials require more pressure? That is done, but there are other limiting factors to the amount of pressure that can be applied to a two roll machine handling soft materials. At high pressure levels, the material stops feeding and slips on the rolls.

Here's how the design of the Stacomizer permits the use of increased oil pressure. Three rolls are used. A free floating ring runs between two rolls and the materials being pressed passes between the inner roll and the inner surface of the ring. The schematic sketch, Figure 1, shows the operation very clearly. Figure 2 is a picture of the 16x26 inch machine which is designed for a total separating force between the rolls of 100 tons.

Floating Ring Rotates with Work

Driving power is supplied through a 40 hp electrically driven gear reducer to the inner roll. Available surface speeds on the inner roll are 50 fpm. The end of the inner roll which is coupled to the drive is machined square and the coupling is made to permit movement of the roll. Through pinions, the inner roll drives the backup roll. The floating ring is not driven.

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VALVES
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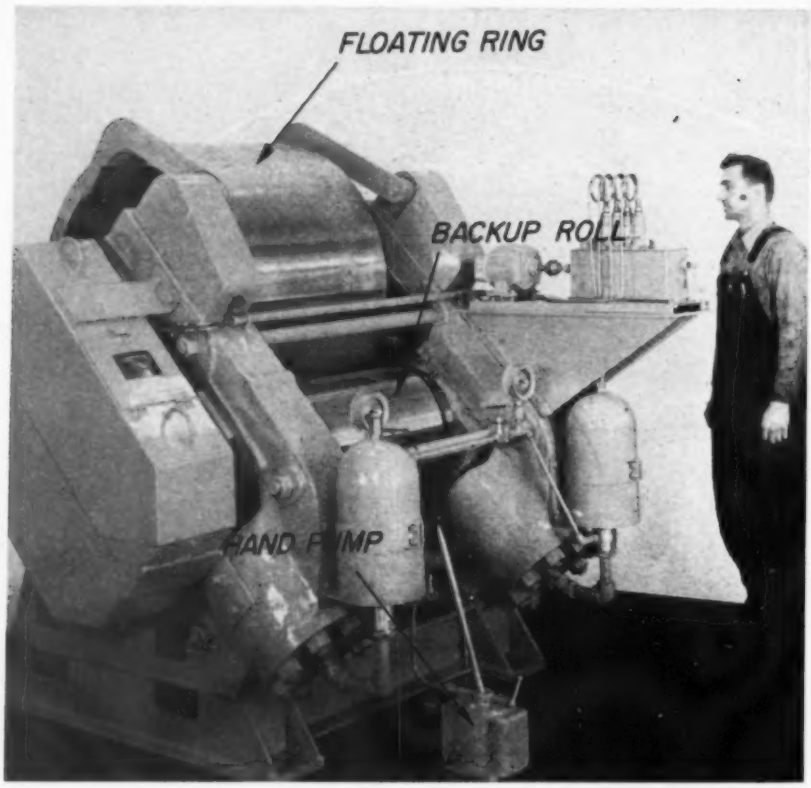


FIG. 2. ROLLS are pressure loaded by this accumulator system. The hand pump charges the hydropneumatic accumulators to 3000 psi. On this 100 ton machine, 8 inch cylinders are used.

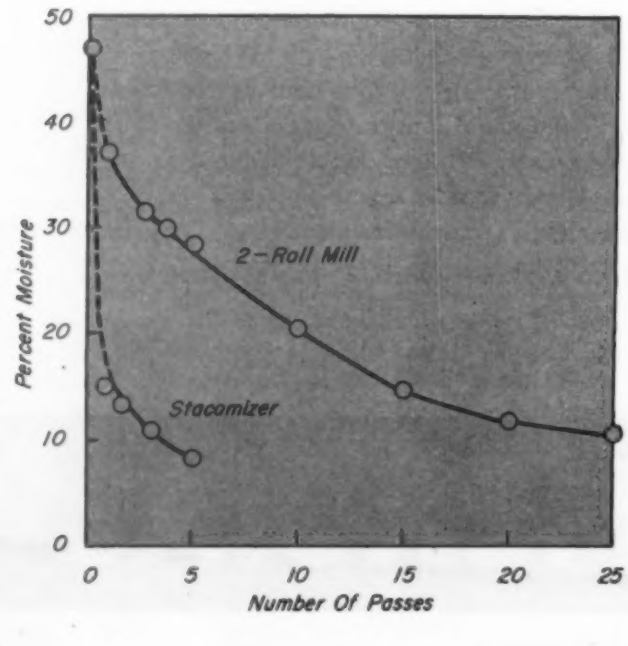
It rotates with the work roll by riding on a blanket of the material being processed and automatically adjusts to an equilibrium position which changes to compensate for varying feed conditions.

The material to be processed is fed from a feed chute into the lower part of the floating ring and is carried upward into the horn angle formed by the work roll and the inside surface of the floating ring. As the material comes under pressure, the floating ring dips, and acting as a lever, forces the inner roll to move. This opens the throat of the angle by advancing its apex above the horizontal plane of applied pressure.

The material is compressed into a blanket which is rolled through the assembly under the high hydraulic nip pressure, with a minimum of shear or grinding action. Extracted fluids flow by gravity from the bottom of the floating ring. The processed material is removed by scrapers and conveyors.

Development of the hydraulic system has gone through several interesting steps. On the first full scale models having 30 inch diameter inner and backup rolls of 40 inch face, and a 60 inch i.d. floating ring, an air-hydraulic intensifier system was designed. This unit had its own air compressor, and the large intensifier cylinder which was vertically supported on a stand stood about 12 feet high.

FIG. 3. MORE moisture is removed from wet rubber by using the 3-roll machine as compared to a standard 2-roll mill.



Accumulators Supply Pressure

This power system has been supplanted by the compact oil circuit seen on the machine in Figure 2. On this machine the rolls are loaded by oil pressure acting on two 8 inch diameter single acting cylinders. Two 2½ gallon bladder type hydropneumatic accumulators supply pressure oil to the system. Precharged with nitrogen at 900 psi, oil is then pumped into the ac-

Concluded on page 118

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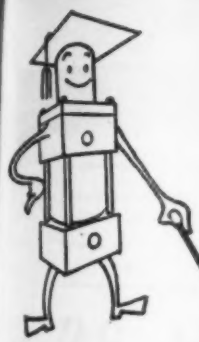
FLUID PRESSURE BOOSTERS



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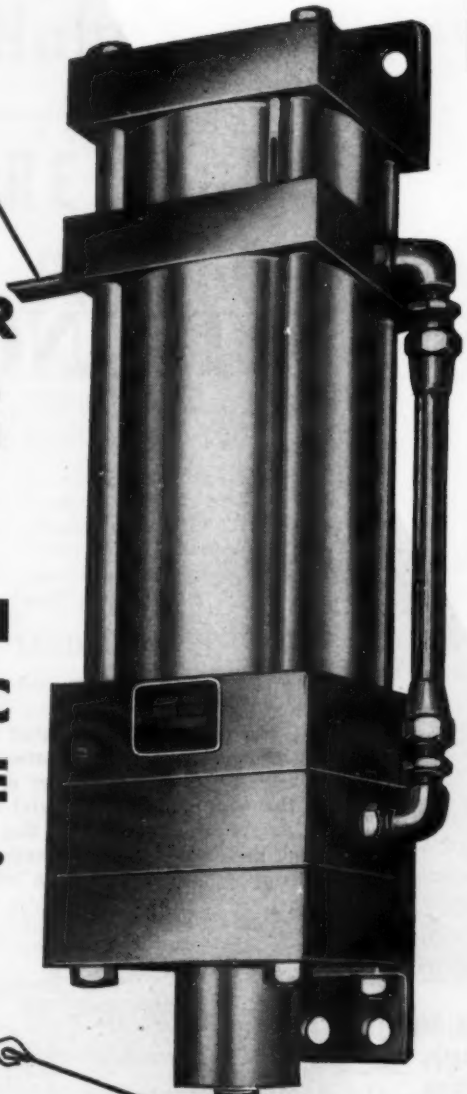

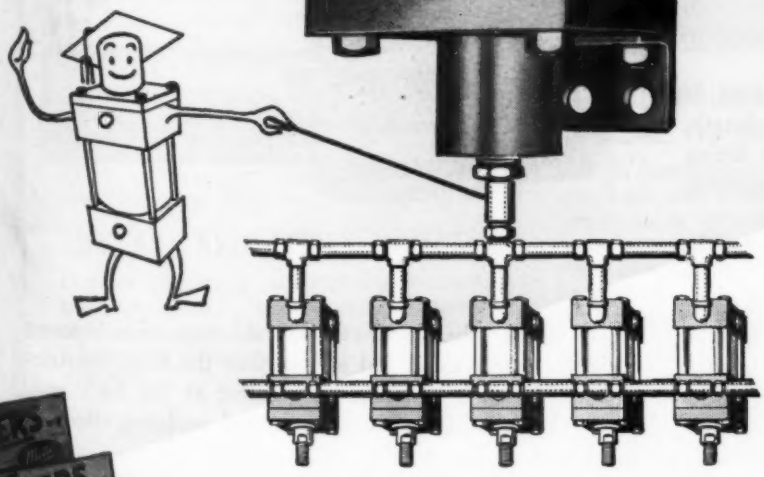

- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- **Hold pressure indefinitely** without the motion and heat generation of ordinary pump circuits
- Provide — at point of cylinder thrust — more efficient power with less weight in less space than direct driven air cylinders
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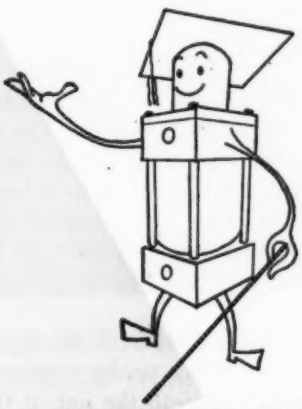

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FLARELESS FITTINGS

By R. W. Phillips

Aircraft Fitting Flareless Fitting

This fitting which has been on the market for the past three years consists of three parts. The parts are (1) a nut, (2) a sleeve and, (3) a connector, Figure 1. The sleeve consists of the inner-sleeve and outer-collar, which are securely assembled at the plant forming one piece integral for assembly in the field. The fitting is shipped assembled ready for installation of the tube.

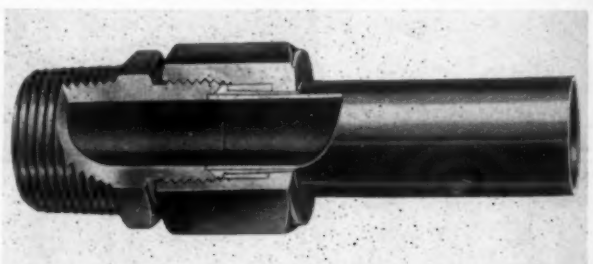
Assembly of the fitting to tube is accomplished as follows: First, cut the tubing to the required length, and burr. Then insert tube into the nut of the fitting to the full extent of the stop provided in the connector, and tighten the nut to full stop position.

The nut cannot be intelligently over torqued on the tube, thereby causing an excessive reduction of the tube orifice and consequent reduction of flow, for the reason that a definite stop is in evidence when the nut has been tightened to the correct position on the connector.

The tube is tightly gripped and a permanent seal is obtained by the following method: the front end of the inner-sleeve is provided with a taper cone portion which abuts into the receiving cone seat of the connector. The back end of this sleeve is developed with an elongated tapered surface, this tapered surface being of a lesser degree than that provided in the bore of the outer-collar. The outer-collar is produced from steel for all application and is heat treated to obtain a high tensile. It is provided with a tapered bore of *greater* degree than the elongated taper surface of the sleeve, above referred to, and to which it is attached.

As the nut is tightened the outer-collar is driven forward, thereby constricting the inner-sleeve onto the wall of the tube. Due to the variable taper development of the inner-sleeve and outer-collar the final constriction of the inner-sleeve is greatest at the back end, thereby forming an inverse conical wedging effect on the wall of the tube.

Fig. 1. A CROSS SECTION of the assembled Aircraft fitting. The wedging action between the wall of the tube and sleeve offsets the tendency of the tube to disengage from the connector under axial force of line pressure. The long back portion of the inner sleeve extends through the end of the outer collar, providing additional tube support and dampening effect against vibration.



The natural axial force exerted by pressure in the line, which tends to disengage the tube from the connector, is offset by an increasing wedging action between the wall of the tube and sleeve.

Both the inner-sleeve and outer-collar are held in rigid contact with the sealing surface of the connector. This sealing surface cannot be impaired by any axial movement of the tube during extreme operational end pressures to which the tube may be subjected.

The back end portion of the inner-sleeve extends to considerable length through the end of the outer-collar and is so designed as to allow the small bore

HYDRAULICS FOR MOBILE EQUIPMENT

Mobile Equipment News

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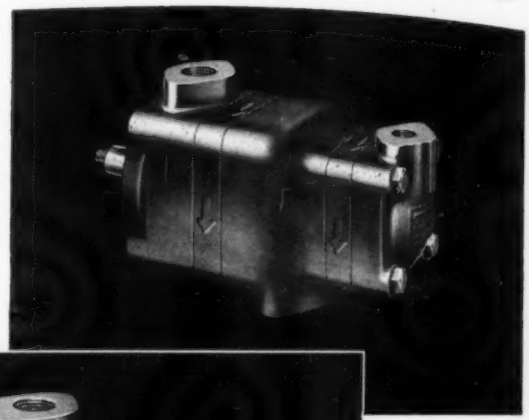
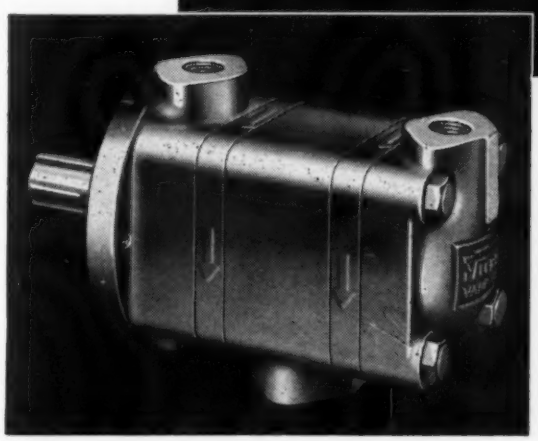
VOL. 1 VICKERS INCORPORATED, DETROIT, MICHIGAN NO. 3

26 MORE VICKERS DOUBLE PUMPS NOW IN PRODUCTION



(Right) Series V-2200 Double Pump in 10 sizes from 3.2 to 32.6 gpm combined delivery.



(Left) Series V-3200 Double Pump in 16 sizes from 11.9 to 51.1 gpm combined delivery.

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Axial compensation is by means of a pressure plate held to optimum running clearance by pressure from the system.

Automatic compensation eliminates need for "run in" . . . efficiency is maximum the first time the pump is started. It also assures maximum delivery over a very long life and with wide oil temperature change.

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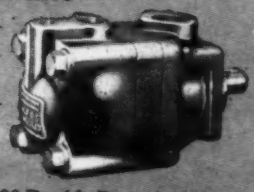
OTHER VICKERS DOUBLE PUMPS FOR MOBILE EQUIPMENT

(Left) Series V-4200 Double Pump in 6 sizes from 30.7 to 70.2 gpm combined delivery.



(Right) Series V-5200 Double Pump in 6 sizes from 48.8 to 89.4 gpm combined delivery.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Flareless Fittings

Continued

in the back end of the nut to iron it down to close or tight contact with the wall of the tube, thereby providing a dampening effect to offset vibration forces.

This sleeve constriction grips the tube with a maximum diametrical constriction to a point furthest from the front end of the tube at the same time allowing adequate tube support at each extreme end of the gripping member. To reassemble after disassembly run the nut down until the nut comes to the full stop position.

Table I

Size	Size No.	Threads	Torques			
			Copper	Alumi-num	Steel	Stainless Steel
⅛	2	5/16-24	65- 80	Same	75- 90	75- 90
3/16	3	⅜ -24	70- 90	"	80- 100	80- 100
¼	4	7/16-20	80- 100	"	90- 110	90- 110
5/16	5	½ -20	110- 130	"	120- 140	120- 140
⅜	6	9/16-18	140- 160	"	160- 180	160- 180
½	8	¾ -16	180- 200	"	200- 230	200- 230
⅝	10	⅞ -14	320- 360	"	350- 390	350- 390
¾	12	1-1/16-12	650- 700	"	700- 750	700- 750
1	16	1-5/16-12	1500-1600	"	1600-1700	1600-1700

The fitting is available in dural, brass, steel, and stainless steel. It will work on almost any type of tubing. It has an advantage over many of the flareless fittings previously discussed in that there is less overlap, reducing the design problem in close couplings situations.

The fittings are available in the sizes listed in Table I. This table also lists the torques to assemble.

Imperial Flex Fittings

There are a number of fittings which make use of rubber or some other resilient material as the sealing and holding member of the tube assembly. One of the better known fittings of this type is the Imperial Flex Fitting. This fitting consists of a body, a tube nut and a sealing sleeve of special elastic compound.

The tube bore within the body is considerably larger than that of regular flareless fitting. This allows for tube movement and misalignment of other components when the connection is made. While the overlap problem inherent in flareless fittings still exists, this larger bore facilities springing tube into position.

The tubing is held in place and sealed by tightening the tube nut to the positive stop incorporated in all the body shapes. This allows the correct amount of predetermined resiliency and prevents undue extrusion of the sleeve.

Figure 2 is a cross section of the Flex Fitting after assembly. On sizes larger than ½ inch O.D. and on applications where higher pressures are involved, the end of the tube should be belled slightly as shown. This controlled extrusion forms a cushion around the tubing to absorb vibration and shock. Also, due to the positive body stop, torque values in making the joint are unnecessary.

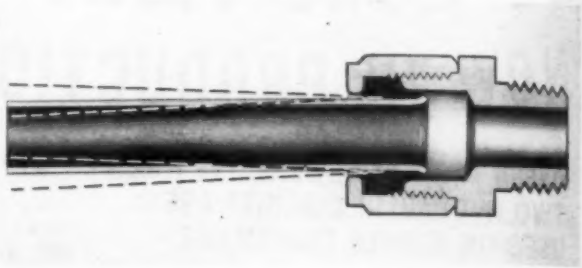


Fig. 2. A CROSS SECTION of the Flex Fitting of a size larger than ½ inch O.D. On larger sizes and where higher pressures are involved, the end of the tube should be slightly belled as shown.

Flex fittings are comparatively easy to install. For low pressure work there is no need to fabricate or prepare the end of the tube. It is only necessary to slip the nut and sleeve over the tubing, insert the tube into the body until contact is made with the tube stop and tighten the nut to the body stop previously described. Because of recent advances in the development of resilient materials, former limitations in the use of the fitting have been lowered considerably. The fitting in general is intended to be used in applications where major vibration, and/or minor tube movement takes place. While it is not intended to replace flexible hose in all instances, it has been used successfully as a replacement where conditions were not severe enough to warrant this expensive equipment.

The next installment will complete the series of flareless fittings.

June 1st is Prize Paper Deadline

IF YOU intended to submit an entry in the APPLIED HYDRAULICS Prize Paper Contest, *now* is the time to get your data, drawings, pictures and arguments together. Some papers are already in, others will come in during May. Early entries are being circulated among the judges.

You still have time to compete for the major prizes. Entry Blanks, Rules of the Contest and Suggestions for Contestants will be sent to you by return mail. Cash awards will be made after the last paper postmarked before midnight May 31st has been read and evaluated.

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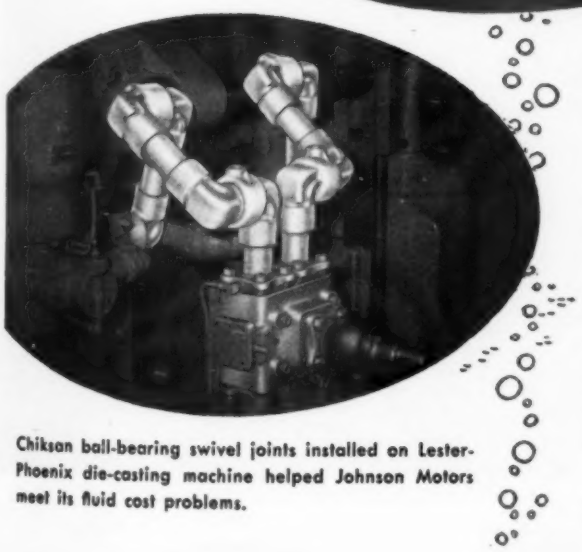
Chiksan ball-bearing swivel joints have helped to reduce fluid losses from 40,000 gallons per year to 10,000 gallons. In contrast to former loss of from 1 to 3 gallons in repositioning bolted lines, Chiksan joints permit resetting of table level with virtually no fluid loss. Time consumed in resetting table levels has been reduced from 2 men and 1 hour to one man and 15 minutes of time.

This story is typical of the many ways thousands of manufacturers are using Chiksan ball-bearing swivel joints for greater safety, efficiency, and economy in their operations.



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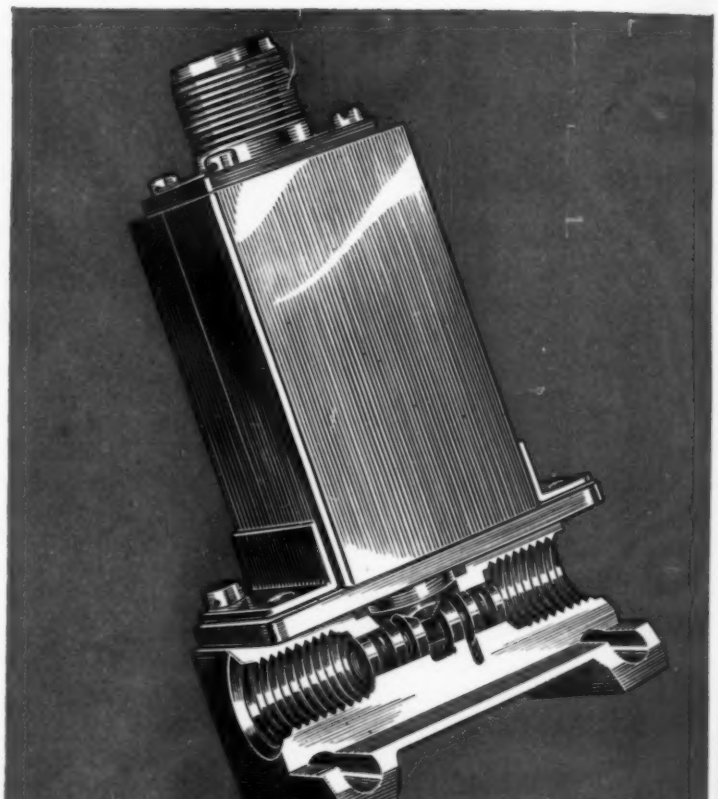

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Using Hydraulic Pressure RELIEF VALVES Correctly

By Gerhard Reethof

A fact well known to those dealing with hydraulic circuits is that some systems containing relief valves have an objectionable chatter under certain operating conditions, while other similar systems behave smoothly at all times. There have been instances when unstable hydraulic systems were quieted by replacing the relief valve with a component of different design. The false conclusion was then reached that the relief valve was of poor design or poor workmanship. An attempt is made in this article to show that it is fallacious to assemble blindly the various components to form the complete system without consideration of their individual dynamic characteristics. Current information and modern techniques of analysis have made possible the design of hydraulic systems on a rational basis and have permitted the prediction of probable performance. Such systematized design techniques already evolved for servomechanisms will no doubt soon become common practice in the hydraulics field as higher and higher pressures are called for with lighter and faster systems.

The hydraulic pressure relief valve is used primarily as a pressure-limiting device. It can, therefore, be considered, in its most common usage as a safety device. As such it will operate intermittently and return a certain fraction of the high pressure fluid directly to the reservoir. The function of bypassing, or in effect throttling, high pressure fluid should be performed smoothly with a minimum of noise and a negligible pressure rise above the cracking pressure. Furthermore, the valve should act quickly to reduce the excessive pressure.

In its broadest sense, the relief valve will consist of:

1) A pressure measuring device that compares the system pressure with the desired relief pressure.
2) A device that acts to reduce the system pressure to the desired pressure limit.

The function in very simplified form can be represented as a closed-loop system, as shown in the block diagram of Figure 1.

Contemporary relief valve construction can be di-

GERHARD REETHOF, Department of Mechanical Engineering—Massachusetts Institute of Technology; Design Consultant —Pantex Manufacturing Corporation

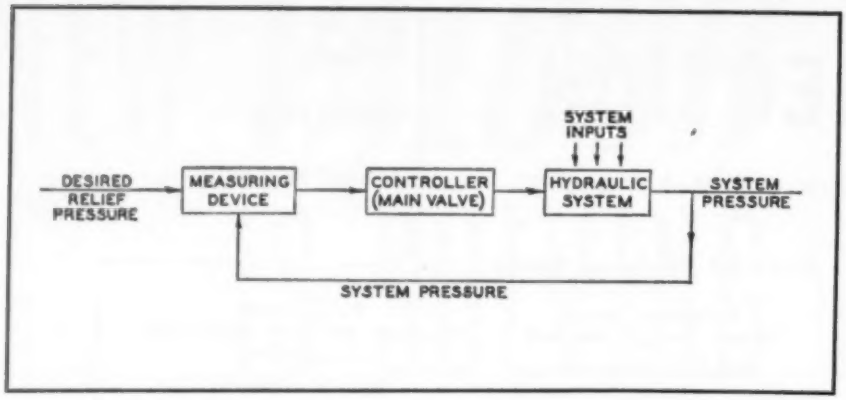
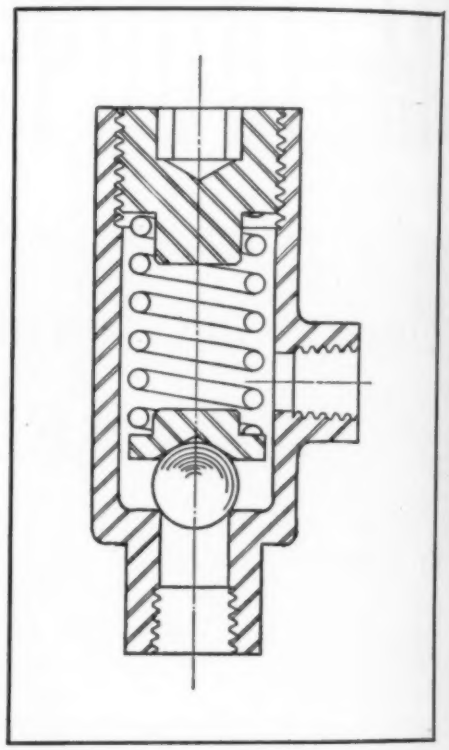


FIG. 1. Fluid pressure relief valve and hydraulic system represented in the form of a block diagram. Of particular interest is the fact that a closed loop system results.

FIG. 2. Simple single stage relief valve showing the basic construction.



vided into two distinct types:

1) The simple single-stage valve.
2) The more complex pilot-operated or two-stage relief valve.

The single-stage valve consists of a poppet or ball which is held against a seat by a preloaded spring. Relief will take place when the adjustable preload on the ball or poppet, the spring force, is exceeded by the pressure force. The difference in forces results in an opening of the poppet in a way so that a condition of force balance is maintained, with the pressure force now being equal to the increased spring force. However, in the absence of the force balance, a net force will act on the poppet, giving it the acceleration necessary to start its motion toward the equilibrium position.

The limitation of the single-stage valve illustrated in Figure 2 rests on the high pressure rise for normal flows that is inherent in this design. In order to reduce the pressure rise, either the seat circumference must be increased to lessen the necessary valve motion, or the spring must be made inordinately long. The first procedure results in a heavy poppet, the second case in a softer spring. Both instances lead to a slower response to rapid pressure fluctuations.

A more preferable design is a pilot-operated hydraulic relief valve such as the valve shown schematically in Figure 3. The greater accuracy and reliability is obtained by first amplifying the output of the measuring means and then using this higher power level to operate the control valve.

The system pressure is sensed by the spring-loaded pilot poppet. If the set pressure is exceeded, the poppet opens and throttles oil into the ram space of the main control valve. The pressure rise in this chamber results in a lifting of the ram and an opening of the main control poppet.

Because of the relatively weak main poppet spring and the small leakage past the ram, the main valve responds very rapidly to pressures in excess of the manually set cracking pressure. Thus, very shortly after the pilot valve has opened, the main valve attains a certain velocity. In effect, the main valve will tend to integrate the error in system pressure as sensed by the pilot poppet valve, during the opening process. In effect the main valve will assume a certain velocity for a small opening of the pilot valve during the opening process. The motion of the main valve will stop when the leakage flow past the main valve equals the flow through the pilot valve. In closing, however, the ram of the main valve acts as a dashpot, insuring well damped behaviour and protecting the main valve seat from excessive pounding.

The feature of having a pilot valve position result in a main valve velocity makes it possible to design a very small pressure rise above cracking, for even the highest flows, into this type of relief valve.

The Hydraulic System

Of the many problems that arise in hydraulic system operation, two types of objectionable behaviour are of particular interest to the manufacturers and user of hydraulic relief valves: squealing or singing which is found in many types of valves besides the hydraulic relief valve, and relief valve chatter. Valve squeal is believed to be the result of a flow transition phenomenon which occurs for very small poppet open-

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. . . individual dynamic characteristics of each component should be considered when assembling a complete system . . .

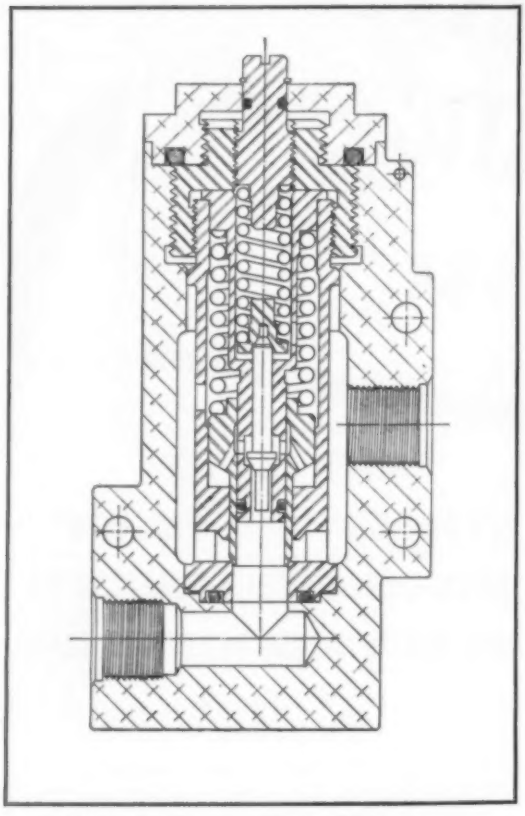

FIG. 3. Pilot operated relief valve.

ings. The frequency of this oscillation is usually in the high audible range. The squeal is known to disappear as soon as a certain critical opening of the poppet is exceeded. Of considerably greater interest, however, is the valve chatter. It is a sustained oscillation of much lower frequency than the squeal and may result in large pressure fluctuations which are injurious to the hydraulic system.

The fact that valve chatter is as a rule accompanied by rapid pressure oscillations of an identical frequency as the chatter frequency leads to the belief that the relief valve alone should not be blamed. The relieving procss is actually a very complex dynamical situation resulting from the interaction of the components of the system.

During the bypassing of fluid the pilot-operated relief valve, Figure 3, is extremely sensitive to pressure demand changes. It is a system consisting of two inertias, the pilot valve and the main valve, which are interconnected by the equivalent of a stiff spring, namely, the compressible fluid in the connecting chamber and the fluid flow through the pilot orifice and the annular space in the ram. Furthermore, each inertia is connected to the case through a spring and dashpot (a damping member). The system of masses can be thought of as floating very delicately about a sensitive equilibrium.

The other members of a typical hydraulic system of which the relief valve is but a single component, are:

1) A Motor Driven Pump

This combination has very definite and predictable dynamical properties. The electric motor-pump system responds to both pressure and flow changes with changes in speed which immediately reflect into the hydraulic system. It can be shown that the motor-pump combination can be represented as an inertia connected to ground by a spring and a damping device. The characteristic time of such a device, namely the time for one free oscillation resulting from a sudden disturbance, is as a rule not too different from the characteristic time of the main poppet in the relief valve.

2) An Accumulator

The accumulator is an energy storage device which comes into action when sudden pressure changes occur in the system. Under such conditions it will supply or absorb hydraulic fluid in a manner that will tend to reduce the pressure change. It can therefore be

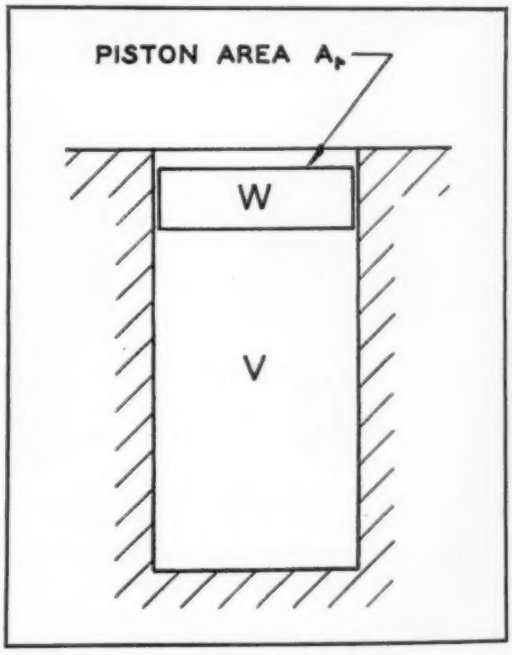

FIG. 4. Diagram of a hydraulic system consisting of a volume of fluid V under compression acted upon by a frictionless piston of weight W and area A_p.

likened to the action of a light dashpot and a spring where the force in the spring is equivalent to the flow from the accumulator. The positions of the dashpot and the free end of the spring can be compared with

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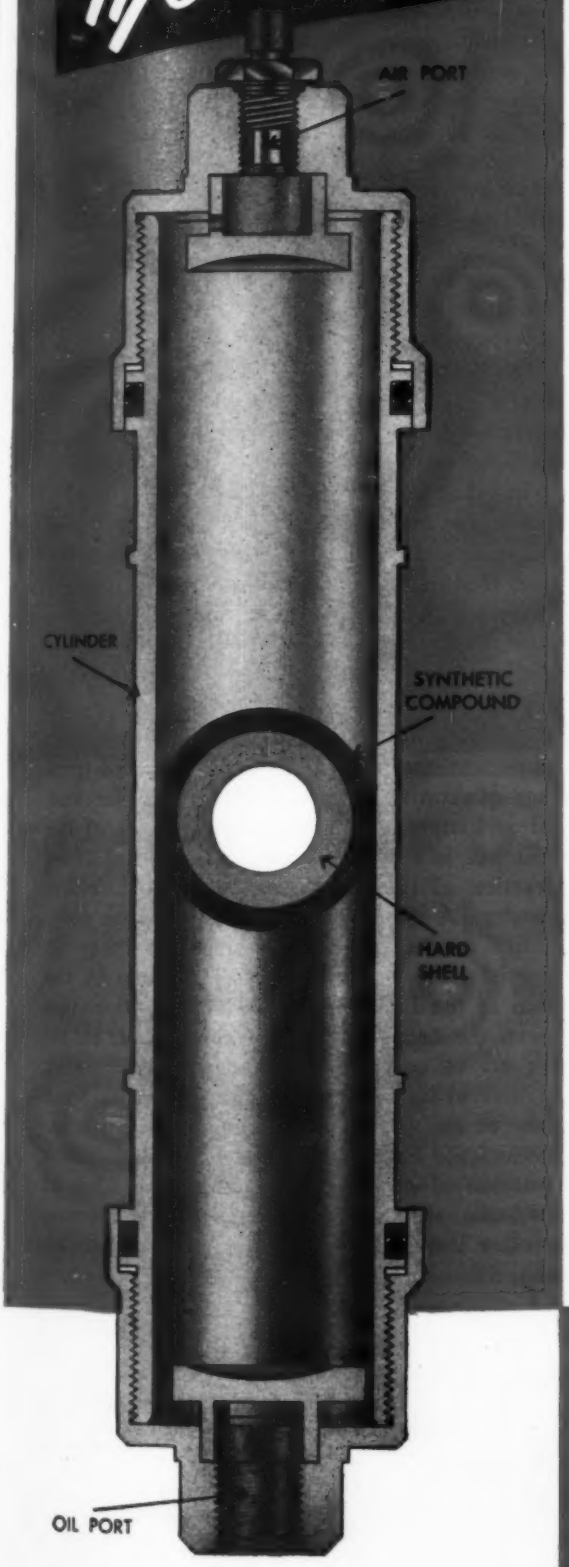

THE H/S Hydraulic Accumulator differs from other hydraulic circuit devices for the storage of energy in that it employs neither a compressible bag nor a conventional piston.

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OPERATING as a piston, the ball, slightly larger than the cylinder diameter, forms a perfect seal at all times. Under pressure the rubber is displaced outwardly toward the cylinder walls and always forms a perfect seal for the pressures applied. Thus *the greater the pressure, the tighter the seal.*

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. . . relief valve chatter is not the fault of the component . . . it is a systems problem . . .

the accumulator pressure and the system pressure, respectively.

3) A Ram-Controlled Load

Since the load has considerable inertia, large system pressure variations are required to change its velocity. This pressure originates at the hydraulic pump. However, there is always a certain volume of high pressure hydraulic fluid between the pressure and flow source, and the load. Though hydraulic oil is usually thought of as being incompressible, actually this is not the case. For most normal operating conditions the compressibility of hydraulic oil, a bulk modulus is approximately 300,000 psi. The bulk modulus is the change in pressure of a certain volume of fluid caused by a small change in its volume, as expressed by the following equation:

$$\beta = V\frac{dP}{dV}$$

where β = Bulk Modulus = lb/in^2
V = Volume = in^3
P = Pressure = lb/in^2

Thus a one per cent change in volume of a certain mass of a fluid will be the result of a pressure change of 3000 psi. In effect, therefore, the compressibility of the hydraulic fluid acts as a spring connecting the pump to the load. As a further demonstration of the compressibility of hydraulic oil, consider a 25 pound mass resting on a piston in a cylinder of 1 in^2 area which is filled with 100 in^3 of hydraulic oil as sketched in Figure 4. The piston will oscillate with a frequency of approximately 34 cycles/sec when disturbed. The relation expressing the frequency of the free oscillations to the various pertinent physical quantities is given by

$$\omega_n = \frac{A_r}{2\pi}\sqrt{\frac{386\beta}{WV}}$$

where ω_n = frequency in cps
A_r = Ram Area = in^2
β = Compressibility = lb/in^2
W = Piston weight = lb
V = Volume under piston = in^3

The frequency of free oscillations is thus proportional to the ram area, but most interesting of all is inversely proportional to the square root of the volume under compression.

On the basis of the foregoing discussion, it is quite evident that the behaviour of the various components results in a very complex interaction. The question arises concerning the mechanism that might cause a sustained oscillation of the system pressure, the poppet displacement, or some other physical quantity. A somewhat simplified analogy will be used to explain this phenomenon of system instability. In Figure 1 the block diagram of a typical hydraulic system shows that the measuring device performs an act of subtracting two physical similar quantities. In Figure 5 a similar block diagram shows a closed-loop system. In each of the boxes labeled A, B, C, and D the physical quantity coming out of the box lags in time behind the input quantity. In other words, whatever is in the boxes takes time to respond to changes in the physical quantity that enters the box.

When a disturbance in quantity I occurs, it will immediately result in a change in quantity a. However, the character of the mechanism of A is such that quantity b lags in time behind quantity a. If this reasoning is applied to the remainder of the components, it is quite conceivable that quantity e will lag quantity a by so much that instead of reducing a, it will increase a. Such system behaviour results in a steady increase in quantities a, b, c, d and e until the limits of the capabilities of the system are reached. In effect the measuring device, instead of subtracting the quantities a and e, adds them, causing the system instability.

The important conclusion that can be reached from this rather qualitative discussion is that the familiar relief valve chatter is definitely not the fault of the component but is a systems problem, resulting from the interaction of the components of the whole hydraulic system. A relief valve that may perform quite satisfactorily in one particular system, still may be quite unsatisfactory in another. It is possible by the application of the fundamental physical relationships that govern the behavior of each component, to arrive at a set of equations that completely describe the behaviour of the system being studied, within the limitations of the initial assumptions. Modern computing techniques have been found to be well suited to the solution of such problems. The application of these methods, although not giving exact answers, will afford a tremendously greater insight into an admittedly difficult problem.

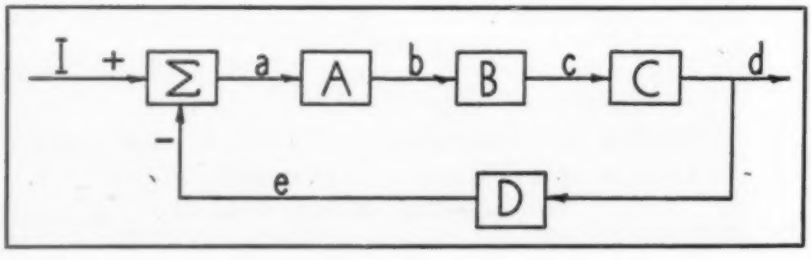
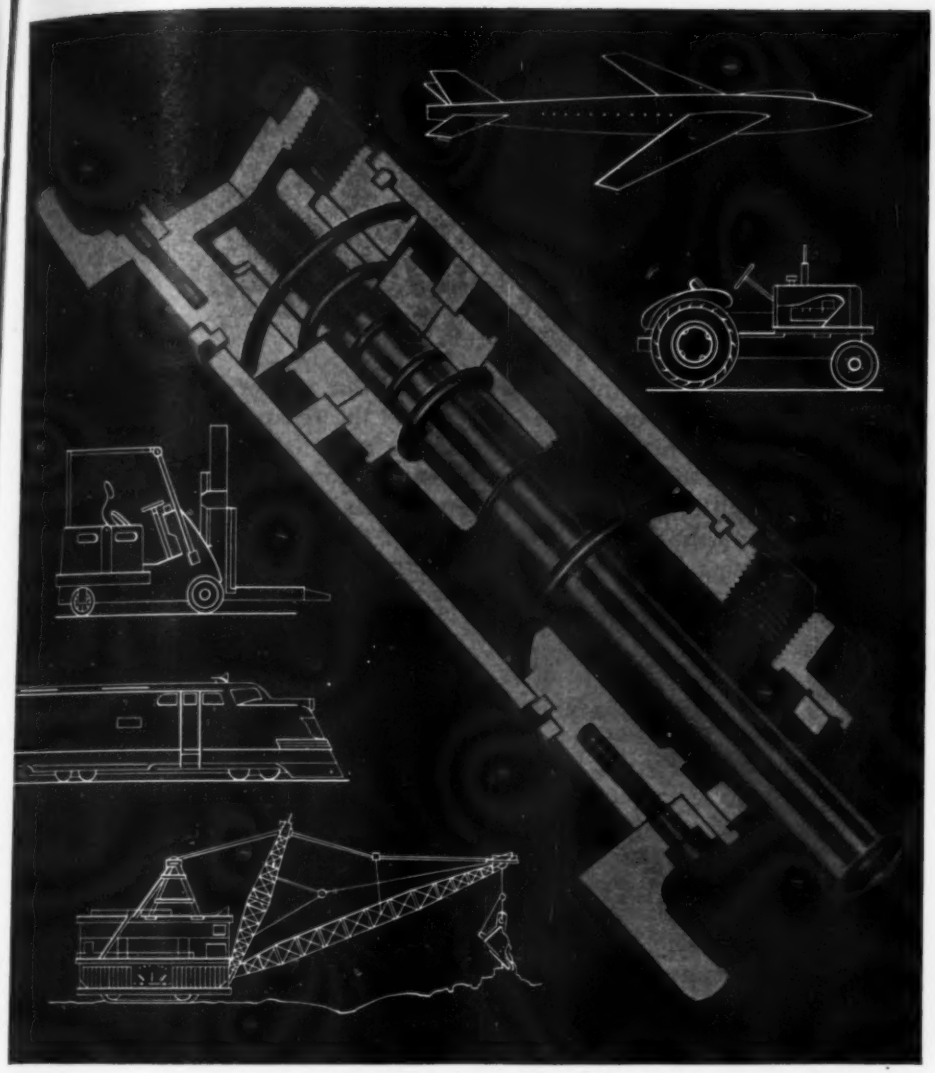


FIG. 5. Block diagram of a typical closed loop system.



Cutaway view of an Ortman Miller Machine Co. Standard Hydraulic Cylinder showing PARKER O-rings.

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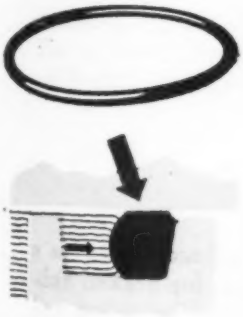

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We are pleased to make this opportunity, especially for our readers in the aircraft manufacturing and supply industries, to "meet" the entire Editorial Advisory Board of our Aviation Section. Much of the material which appears in the Aviation Section is due to the efforts and suggestions of these men. This group, leading hydraulic and pneumatic specialists with representative airframe manufacturers, have given generously of their time and experience to insure that this material is authoritative, current and useful.

Philip Musa

Phil has been employed since his student days by Grumman Aircraft Engineering Corporation, where he worked during his summer vacations. After graduation from Hofstra College in 1941, he entered the Grumman engineering department. He has been associated with aircraft hydraulics ever since and is now Hydraulics Engineering Group Leader.

When Phil is away from the plant, the most likely place he can be found is on Long Island Sound. He is addicted to small boat sailing. Phil is one of the newer members of SAE A-6 Committee.

Harold E. Wells

Another old timer in point of service, Harold, after attending Union College and the University of Buffalo, has been engaged in the design of aircraft for 23 years, sixteen of which have been at Bell Aircraft Corporation. His various assignments have included Design Engineer, Project Engineer and other supervisory responsibilities. He has been instrumental in inventing and developing among other components, the nose wheel centering device, the nose wheel vibration dampner and the pneumatic stabilizer actuator. He has contributed to the development of many aircraft, such as the P-39, XP-83, X-1, X-2 and X-5.

Recently, Harold joined the General Engineering Laboratories as Senior Test Engineer and Hydraulic Consultant. It is easier to get Harold to talk about small boat sailing than his work. A regatta contestant on Lake Erie, he has medals to prove his hobby is successful.

Dwight E. Leach

After leaving Antioch College in 1927, Dwight worked successively as a Mechanic, Service Man and finally as a Design Engineer for Fokker. Subsequently, he spent nine years as Design Engineer, Group Supervisor and Staff Engineer for Brewster. After a short period with Consolidated-Vultee during the war as Hydraulics Group Engineer, he joined Chance Vought Aircraft in a similar capacity. Recently he has been transferred to the Controls and Hydraulics Staff Group as a Staff Engineer.

Dwight is a member of SAE Committee A-6. Incidentally, he is the only Advisor who wears a ten gallon hat. We don't know how long a residence in Texas it requires to wear it like he does. After all, you don't ask Texans foolish questions.

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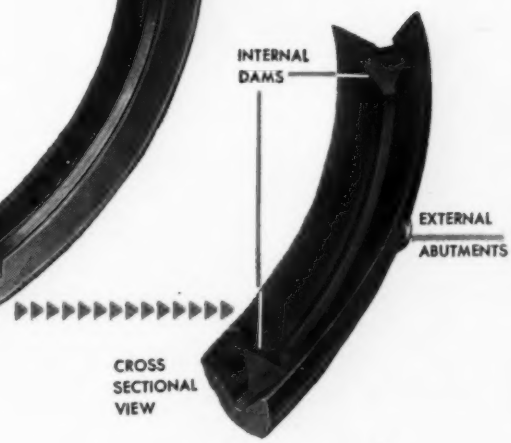

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Introducing the Aviation Section Editorial Board

Continued

Frederic H. Pollard

Following graduation from New York University in 1929 Fred worked a short time for the American Telephone and Telegraph, then for eight years he was superintendent of a plant engaged in the manufacture of artist materials. Early in 1943 he went to Republic Aviation Corporation with the intent of returning to the artist material field after the war. However, the aircraft bug bit him and he stayed on.

At Republic he was placed in the Hydraulics Group and successively became Group Engineer and Hydraulic Staff Engineer. He is currently Assistant Project Engineer in the Special Projects section and is engaged largely in the development of new types of hydraulically powered flight controls to produce greater maneuverability at high speeds.

Fred is a member of SAE Committee A6 on Hydraulics and Pneumatics and SAE Committee A3 on Fittings and Hose.

Frank C. Mittell

A native of Savannah, Georgia, Frank won his degree in aeronautical engineering at Alabama Polytechnic Institute in 1933. After two years as a lubrication engineer for Sinclair Refining Company at Atlanta, he went to California, where after three years of design work on petroleum equipment and thermostatic controls, he joined the Hydraulic Design Group of North American Aviation, Inc., as Design Engineer and Draftsman in 1939. In 1947 he was named Assistant Hydraulic Group Engineer and in 1950 as Hydraulic Group Engineer. In all, Frank has spent 14 years on hydraulic design for North American.

Frank is a member of SAE A-6 Committee.

Ralph E. Middleton

Ralph took a degree in aeronautical engineering at the University of Michigan in 1929. First employed at Wright Field, he rose to head of the Hydraulics and Shock Struts Laboratory. In 1940 he went to Curtiss-Wright, St. Louis, where he was Staff Engineer, Landing Gear. Going west in 1941, he became Chief Engineer, later Vice President in Charge of Engineering at Aircraft Accessories at Burbank. He remained there during the war. After a period in which he was in business for himself, he was one year, until 1948, with Western Hydraulics as Chief Production Engineer. In 1950 he joined Lockheed Aircraft Corporation as Design Specialist in hydraulics and pneumatics on the Mechanical and Hydraulics Staff. He holds numerous patents on various valve designs.

Wayne S. Boals

With a B.S. in Mechanical Engineering from the University of Minnesota, Wayne went to the Armament Laboratory of the Air Materiel Command at Wright Field where he spent six years, 1939-1945. The next four years he spent with the Cornelius Company at Minneapolis in the design of pneumatic systems and components for aircraft. Since 1949 he has been with the Hughes Aircraft Company as Project Engineer on aircraft armament and associated pneumatic equipment.

Wayne is a member of the Pneumatics Sub-Committee of SAE Committee A-6.

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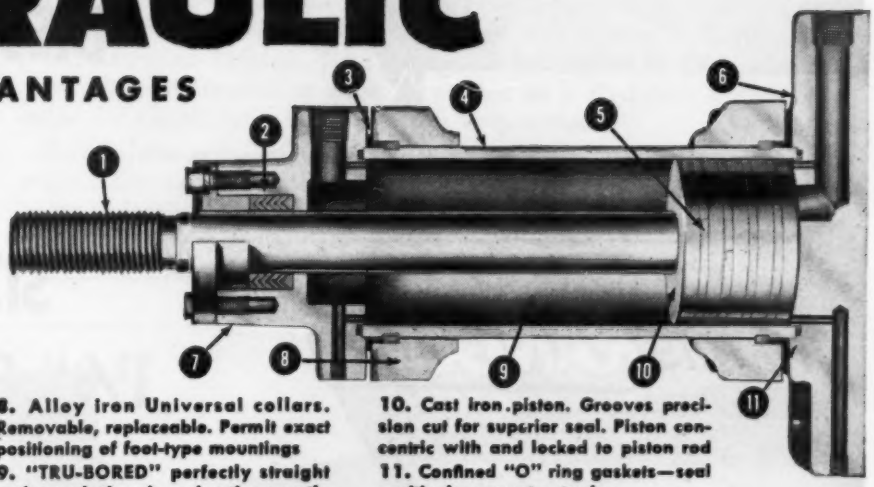

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Harry Cornish

A native of Denver, Colorado, Harry designed mining and other industrial machinery prior to 1939. In that year he joined the Douglas Aircraft Company, El Segundo Division as a hydraulic and mechanical engineer. He became head of Hydraulic and Landing Gear Design in 1945 and has served in this capacity since. He has done design work on fifteen different Douglas aircraft, beginning with the SBD (Dauntless) and A20 (Havoc) through his present work, which is concentrated on the A3D, F4D (Skyray) and Model 641.

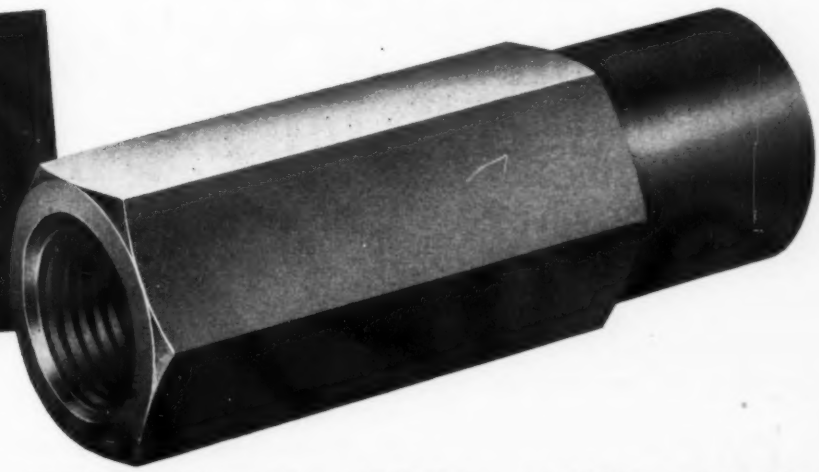
Harry has been an active member of SAE Committee A-6 since 1945.

Howard Field, Jr.

Howard is one of the "old heads" in the aircraft hydraulic business. Educated at the University of Illinois and M.I.T., he has been in the aircraft industry almost continuously since 1915, specializing in hydraulic and control problems since about 1934. He was Chief Hydraulic Engineer for North American Aviation, Inc., for several years prior to 1944, when he opened his own consulting office. At present he is Hydraulic Design Specialist for Consolidated-Vultee Aircraft Corporation.

He has been active in aircraft hydraulic standardization work since the original formation of National Aircraft Standards Committee sub-committee on hydraulics through its elision with SAE Committee A-6 of which he still is an active member. He was the first chairman of the ASME hydraulics committee.

CHECK VALVES



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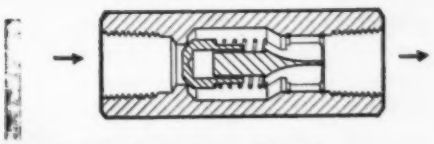

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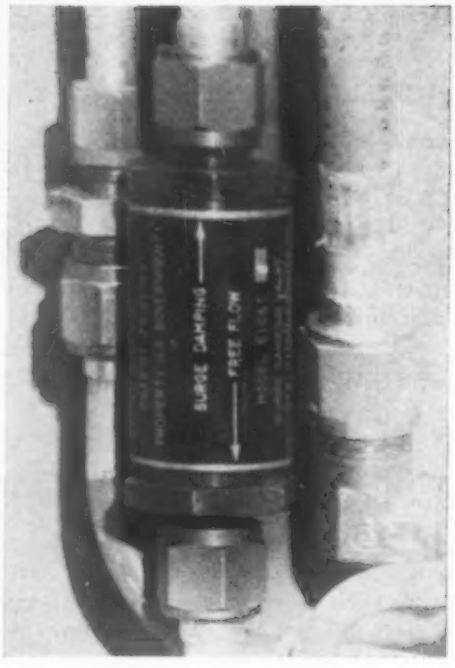


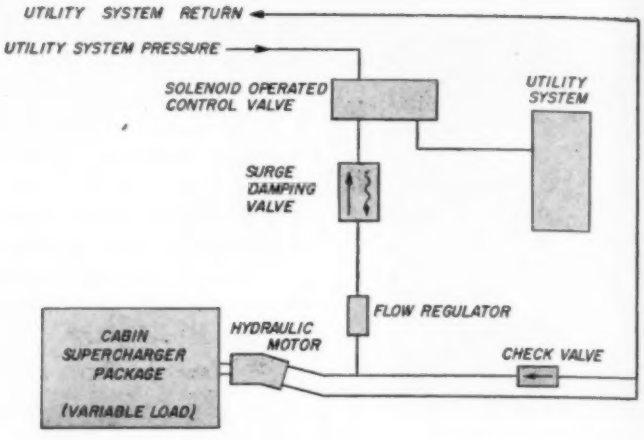


FIG. 1. THE SURGE damping valve on this North American aircraft system, is used between the utility system or accumulator and the hydraulic motor drive of the cabin supercharger. The cabin supercharger motor operates under variable loads to pressures of 3000 psi maximum. In operation, the stored or accumulated power of the utility system is directed to the hydraulic motor through a solenoid operated control valve.

Control of HYDRAULIC SHOCK in Aircraft Lines

By C. E. Adams

ON aircraft, continuous oil pressure surges can cause fitting fatigue and sudden failure of the hydraulic system. Sudden stopping, starting or reversing direction of flow sets up vibrations that are harmful to the airplane's entire hydraulic system. The higher the pressure and the more rapid the shift of flow, the more damage the shock can cause.

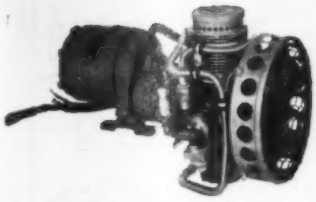
With problems of space and weight confronting the aircraft systems designer, any additional component for the control of surge must be small in size. A damping valve, recommended for systems operating at pressures up to 3000 psi, has been designed with a body length of only 3 inches and a maximum diameter of approximately 1½ inches. A cross-section of the valve is shown in Figure 2 and its application in the hydraulic system of the North American AJ series planes is shown in Figure 1.

In this circuit, the damping valve is designed to prevent, at its formation, the damaging shock impulses that are created by sudden pressure surges from the accumulator to the hydraulic motor which drives the cabin supercharger.

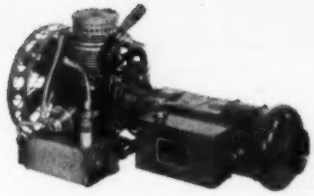
Oscillograph patterns, Figures 3 and 4, show the results of introducing the surge damping valve in a hydraulic system operating at 3000 psi.

The damping valve is normally closed and opens when pressure is applied to the inlet side. There is a controlled acceleration of flow through the valve until fully open. After the period of acceleration, virtual

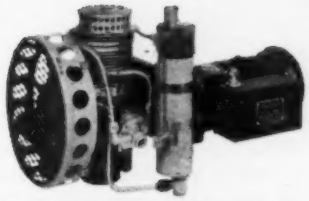
C. E. ADAMS, Chief Research Engineer, The Denison Engineering Co., Columbus, O.



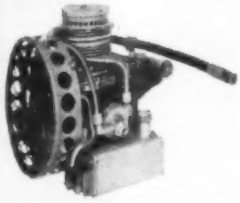
Airborne. 400 cycle — 208v AC drive. Horizontal sump.



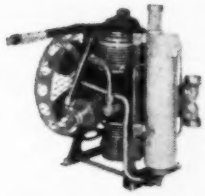
Airborne. 28v — 3½ hp motor. Horizontal sump. Radio noise suppressor.



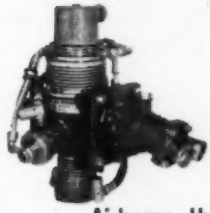
Airborne. 28v — 3½ hp motor. Vertical sump. Radio noise suppressor.



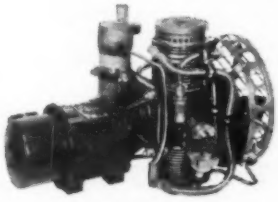
Airborne. Hydraulic drive. 1500 lb. hydraulic system. Horizontal sump.



Airborne. Hydraulic drive. 1500 lb. hydraulic system. Vertical sump. Pressurized inlet.



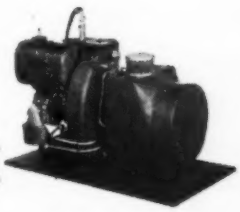
Airborne. Hydraulic drive. 3,000 lb. hydraulic system. Pressurized inlet. Remote sump.



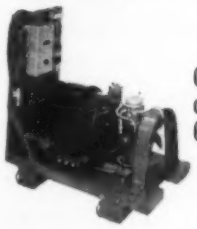
Airborne. 28v—2 hp motor. Vertical sump. At sea level, and at 15,000 ft. delivers 2 cfm of free air compressed to 3,000 psi.

fit a KIDDE 4-stage compressor to your pneumatics needs

in the air . . . on the ground

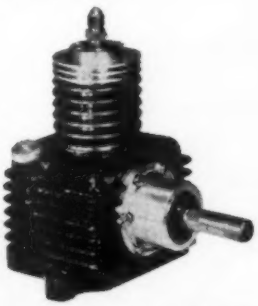


Ground application. Here a portable gasoline motor is used as a driving unit.



Ground application. Here the compressor can be driven by a 60 cycle 220 volt motor.

Except where indicated the Kidde Compressor delivers 4 cfm of free air compressed to 3,000 psi at sea level.



Airborne. For personal planes. Belt driven. Integral sump. At sea level, delivers ¼ cfm of free air compressed to 500 psi.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc. and its associated companies.

Kidde

Walter Kidde & Company, Inc.,

516 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

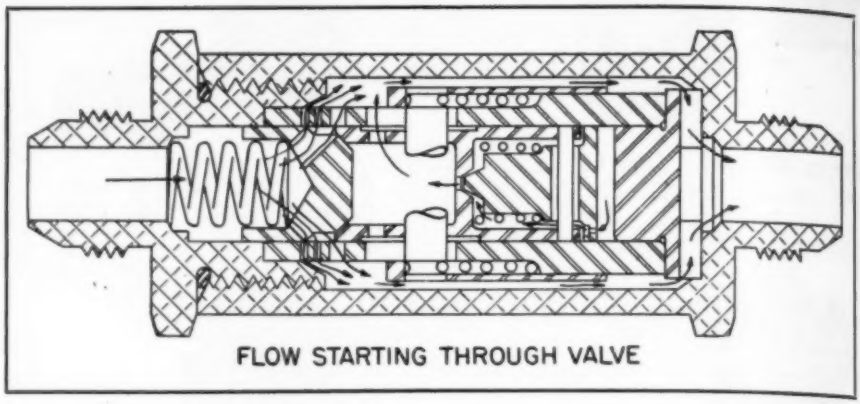


FIG. 2. WHEN A PRESSURE surge is applied to the inlet side of the surge damping valve, there is controlled acceleration of flow until the valve is fully open. Rate of spool movement is controlled by the small poppet and by the difference between the outlet and inlet pressures.

free flow is maintained as long as fluid continues to flow through the valve. When the flow is interrupted, the valve quickly resets and is ready for the next operation . . . only a fraction of a second is consumed in the operation of the control. In fact, the time consumed for the operation of the valve is no greater than the lost motion of shock when no surge damping valve is used.

An unusual feature of the valve is that it will open at a slower rate of speed when high pressures are in effect than at lower pressure, when the valve is subjected to sudden surges of fluid. Also, the rate of flow will increase as the pressure in the outlet line of the valve approaches that at the inlet side of the valve.

The valve is constructed with a spool which is normally held closed with a spring, to prevent flow from inlet to outlet. However, when pressure is applied to the inlet, the spool moves toward an open position. The rate of spool movement is controlled by a small pressure responsive valve and is controlled by the difference between the outlet and inlet pressures. This results in the difference in opening speeds at various pressures.

A common method of shock reduction or prevention is to throttle or slow down the rate of shifting the 4-way and other valve spools. This method requires excess time, because the entire stroke of the spool must be operated slowly, but only a small fraction of this stroke is effective in the prevention of shock, in particular the moment of first opening of ports. Installation of surge damping valves at certain points in a circuit should prevent shock in that circuit with the least possible time consumed for shock prevention for it operates only at the exact moment when shock tends to occur.

For More Information on Surge Control

See APPLIED HYDRAULICS . . .

"Designing for Minimum Surge" by Fred O. Hosterman, December, 1950, starting on page 38.

"Follow Oil Pressures With Electrons" by Ben Main, January 1951, starting on page 13.

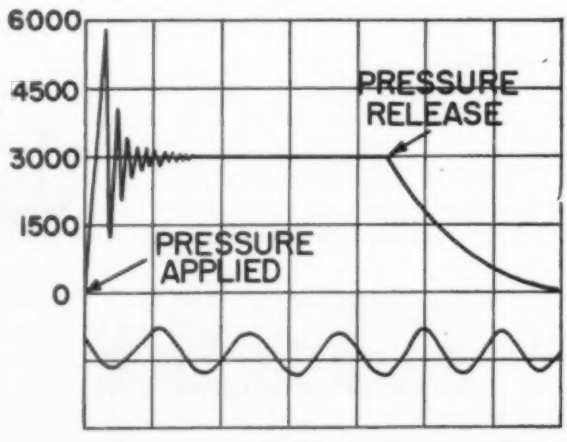


FIG. 3. THIS OSCILLOSCOPE pattern shows the surge pressures which result when pressure is applied to a system without a surge damping valve in the circuit. Severe vibration going to a peak of 6000 psi is induced by the pressure surge.

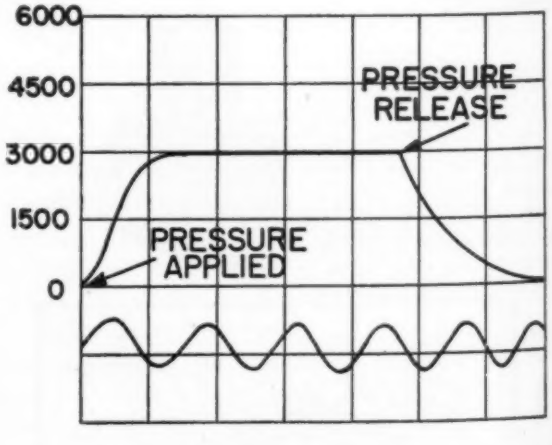


FIG. 4. USE OF the surge damping valve prevents the formation of pressure surges. This pattern shows the pressure buildup free from damaging surges. Time consumed for pressure buildup is no greater than the lost motion of shock shown in Figure 3.

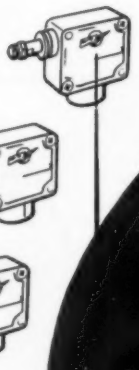
New ELECTRO-SNAP SWITCH

Makes Automatic Sequencing as Simple as 1-2-3...

Die-cast Case Also Available in Splash-Proof Model

EXCLUSIVE ONE-WAY ACTION:

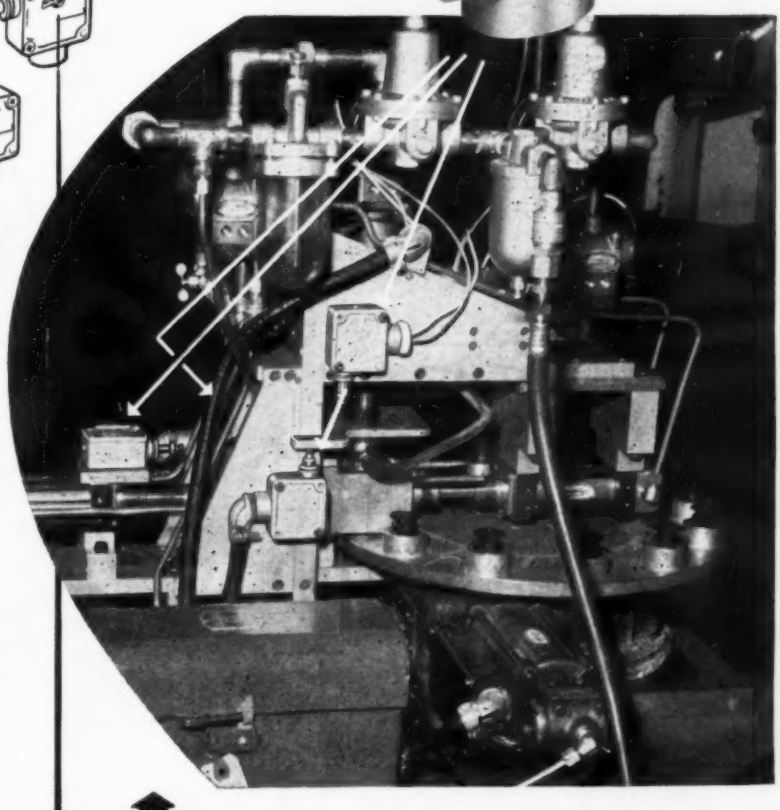
- **Eliminates Interlocking Switches and Complicated Actuating Dogs**
- **Reduces Cost of Designing and Building Automatic Machine Controls**
- **Makes Automatic Operation More Dependable**



Four of Electro-Snap's new Momentary Switches (one not visible) are used in the automatic testing machine at right to operate solenoid valves and air powered cylinders in the proper sequence. When each Momentary Switch is actuated by a small, *pre-determined* part of the forward travel of a machine member, the switch sends an electrical impulse to the next control to be operated. Once the impulse is sent, the switch is out of the circuit. It is not tripped as its plunger or the machine member return to their original position. This one-way momentarily "on" action—exclusive with Electro Snap—allows the solenoid valves to be returned for the next cycle with no need for interlock switches or troublesome one-way dogs to lock impulse switch out of circuit.

In addition to controlling solenoid valves, the Momentary Switch is applicable to pulsing magnetic starters, relays, counters and other electrical controls.

Switch is enclosed in diecast aluminum case. Plunger may be enclosed with splash-proof rubber boot to adapt switch to severe industrial applications.



At Chicago's Allis Seal Corp., machine tests rubber seals used in washing machines. It moves seals into testing position, grasps them firmly in an air vise, closes off top of seal, applies testing air pressure to the seal for five seconds, releases grasp on seal and moves it out of testing position, replacing it with next seal to be tested. This entire sequence, except for loading and unloading, is performed automatically. Machine has proven so successful that two more have been built and installed.

Full information about Electro-Snap Momentary Switches and their use in machine set-ups is available at no obligation or cost. Send for facts today.

OTHER ELECTRO-SNAP PRECISION SWITCHES

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ELECTRO-SNAP SWITCH AND MFG. COMPANY

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this...

or this...

FOR YOUR PLANT
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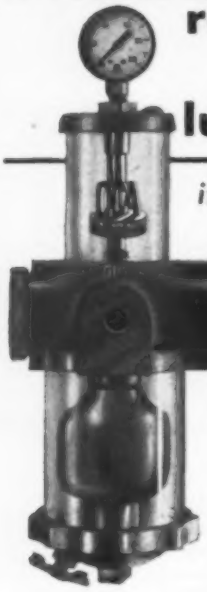
CCA

FOR COMPRESSED AIR

regulator
filter
lubricator

it's years ahead of the field!



Compare CCA's Regulator-Filter-Lubricator with any on the market. You'll find CCA's advanced design nothing short of astonishing! It's more compact—all in one unit—saves space. Installation involves just 2 pipe connections. (Remember—added connections mean added chance of leaks, added expense). It supplies metered lubrication automatically. Filter removes liquid water by centrifugal action. Unit provides piston type regulation —down to ¼ lb. WITH PRESSURE RELIEF FEATURE BUILT IN. CCA is your best buy . . . by far. Stocked in principal cities. Catalog on request.

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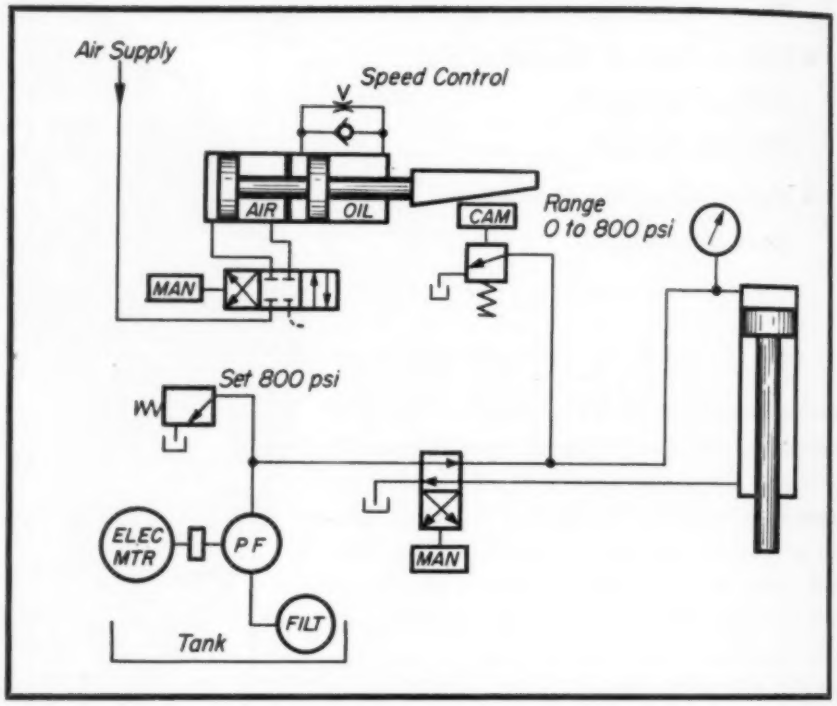
BRECO MANUFACTURING CO.
309 E. SARATOGA ST. • BALTIMORE 2, MD.
Complete line of compressed air line equipment-including Filters, Lubricators, Regulators, DeHumidifiers

Have You Used This Circuit . . . to regulate pressure?

This swaging press was turning out 4 pieces of scrap for every good one . . . until this circuit was used.



AT THE beginning of this job we didn't know that we needed to vary the hydraulic pressure. We ran into the problem on a press which was supposed to swage the end of a straight bronze sleeve bushing around a ball placed in the bushing. We started out thinking it was a simple job, only to find that the press didn't do what it was supposed to do. Split bronze bushings were filling up our scrap barrels.

Jiggle the Relief Valve

Sure, the relief valve pressure was too great. That's what all the "hands on the hips" boys who watched the job said. But, when we ran the relief valve setting a little lower, instead of splitting bushings we just failed to complete the swaging operation on 75 per cent of the pieces.

Okay then, the relief valve setting is critical and we'll have to cut and try until we neither split a piece or fail to swage it. Apparently our fingers didn't believe this logic because we couldn't find any one setting which would reduce scrap below 50 per cent.

The metallurgy boys then stepped in and started talking about heat treating the bushing, changing the kind of bronze and a couple other things that would have cost time and money.

This simple job was getting too complicated. All we had at the beginning was a double acting ram being supplied by an 8 gpm, 1000 psi pump through a manually controlled 4-way valve. A relief valve and pressure gauge completed the circuit.

Coffee Always Helps

Maybe we should have seen the answer right off the bat, but we didn't until we got away from the scrap barrel and the hopped-up ex-

peditors. After a few gulps of coffee, we realized that if we could apply the squeeze more slowly we should be able to roll over the end of the bushing without any splitting. It worked. We ran the adjustment nut on the relief valve back to a pressure setting of 300 psi and brought the ram down to the work. Then by hand we increased the valve setting and the dies slowly closed making a perfect part.

Standing by a press and turning the adjusting nut on the relief valve during each press stroke doesn't make a good showing on a time study report. To beat this problem, we went to the circuit shown here. We added a relief valve which is cam controlled and then added the air-oil circuit to move the cam as the press ram closed on the work.

Easy solution—why didn't we see it sooner?

New York Area Engineers To Hold Fluid Power Session

MEETING under the sponsorship of the Machine Design section of the New York Chapter American Society of Mechanical Engineers, on May 7th at the Engineers Building, 29 W. 39th St., New York area engineers will hear two papers on the application of hydraulic power.

Sabin Crocker, author of the "Piping Handbook," will act as chairman of the meeting. He will introduce Edward M. Greer, President of Greer Hydraulics, Inc., who will discuss "The Growth and Application of the Accumulator in Industrial Hydraulic Systems," and A. J. DeMatteo, Chief Engineer of The Watson-Stillman Co. who will talk about "Hydraulic Circuits for Injection Molding Machines."

Martin Lipton of Compressed Air Products has made the arrangements for this initial meeting which is open to all men in the area who are interested in the design and application of fluid powered equipment. Men attending this meeting will discuss the possibility of forming a group to hold regular meetings on the application of fluid power. A similar group has recently been organized in Philadelphia and engineering societies in other cities have plans for meetings devoted to fluid power engineering.

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every specification is pilot-tested for *Production Quality*

Because engineered packings and oil seals often require special processing . . . Trostel designs and builds the production tools entirely within its own organization.

As soon as laboratory development is completed, Trostel engineers pilot-test the entire production operation in miniature . . . in order to ascertain the processing and tooling techniques which will retain *in production* all of the special properties and tolerances called for in the customer's specifications.

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Oilless bearings 2-4 G.P.M.—0-100 P.S.I. $20.00-$22.50 (two pumps)

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Oilless bearings 50-150 G.P.M.—0-150 P.S.I. $77.50-$200.00 (five pumps)

Series IV—Rubber impeller bronze pumps
Oilless bearings 6-21 G.P.M.—0-30 P.S.I. $16.00-$28.00 (three pumps)

Series 55—Standard bronze rotary gear pumps
Grease fittings 2-23 G.P.M.—0-100 P.S.I. $11.25-$29.00 (twelve pumps)

Series G—Standard bronze centrifugal pumps
Grease fittings 2-25 G.P.M.—2-10 P.S.I. $9.25-$24.00 (three pumps)

See our catalog in Sweet's PRODUCT DESIGN File

OBERDORFER BRONZE PUMPS

Industrial Pump Div., Oberdorfer Foundries, Inc.
535 Thompson Rd., Syracuse, N. Y.

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Do you want a factory representative to call ☐ Yes ☐ No

Gas Compression to 100,000 psi . . . . is obtained with hydraulics

A NEW type of automatic hydraulic compressor, capable of compressing gas to 100,000 psi has been installed in a thick walled concrete cell in the explosives area at the Naval Ordnance Laboratory, White Oak, Silver Spring, Md. Purpose of the device is to facilitate study of the behavior of fuels at gun pressures. The tremendous pressures encountered in the chamber of a gun when it is fired generally have an effect on the fuel which makes it burn differently from the way it does at atmospheric pressures.

AUTOMATIC HYDRAULIC GAS compressor capable of compressing gas, usually nitrogen, to pressures on the order of 100,000 psi, for the purpose of performing experiments in the burning behavior of fuels at gun pressures. On the tripod at left is the pressure "bomb" in which the experiment takes place, while at the right is the pump which provides the 1000 psi hydraulic oil pressure which operates the compressor.

According to Dr. E. C. Noonan, Chief of the Fuels and Propellants Division, two unusual and salient features of the compressor are the automatic hydraulic control and driving system, and the use of "liquid pistons." The compressor consists actually of two sets of double-acting intensifiers, one set in the low pressure stage, both driven by a 15 horsepower pump which maintains a hydraulic pressure of 1,000 psi. Between the low and high pressure stages there is an automatic bypass system that restricts the action of the high pressure stage until a pressure of 15,000 psi is reached and maintained in the low pressure stage. Besides

being more compact, efficient and flexible, hydraulic drive avoids mechanical systems composed of gears, cranks, and shafts, such as would ordinarily be used to drive reciprocating pumps, and which would have to be of prohibitive size in order to handle these high pressures.

"Liquid pistons," the other and perhaps most unique of the two main features of the new gas compressor, are the means used to avoid the necessity for gas seals at the intensifier pistons. Instead of coming directly into contact with the compressing piston, as in a conventional machine, the gas is compressed and confined by a liquid, which in turn is compressed by the hydraulically-driven intensifier piston in another chamber. The gas used at present is nitrogen, although the compressor can utilize practically any gas but hydrogen, which has a way, under high pressure, of escaping into the metal walls of the very chambers that confine it.

It Isn't Too Late—

to prepare your entry for the APPLIED HYDRAULICS Prize Paper Contest. Start putting your material together and ask us for the Rules and Suggestions. Papers postmarked before midnight May 31st will be eligible for prizes.

The liquid used to compress the nitrogen is one developed by the manufacturer which will not dissolve nitrogen and which does not congeal at the high pressures involved.

The compression process begins in the low pressure stage, using nitrogen supplied from regular gas storage cylinders. The hydraulic oil driven by the electric pump acts on a steel intensifier piston which displaces the special fluid into a "liquid piston" chamber, where the actual gas compression takes place. When the pressure in the low pressure stage reaches 15,000 psi a valve opens which permits hydraulic oil to pass into the high pressure stage of the compressor.

On the high pressure side the process is repeated, but at much higher pressures. Here the nitrogen is compressed from 15,000 psi to 100,000 psi. From here it is forced into a pressure "bomb," in which the actual experiment takes place.

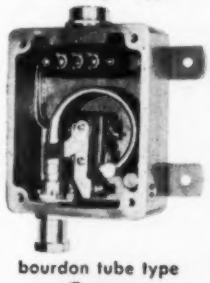
This new compressor is a custom-made machine, constructed to the most critical manufacturing specifications by Harwood Engineering Company of Walpole, Massachusetts.

Metals used in it are special alloy steels, heat treated and inspected with great care. Nearly all parts of the compressor are finished by precision grinding. Before leaving the factory it was subjected to test pressures of the order of 165,000 psi, to insure a healthy margin of operating safety. The automatic gas compressor is an important tool for research and development in extreme high pressures—a relatively new field.

Barksdale-Meletron

PRESSURE SWITCHES

diaphragm type



bourdon tube type

piston type

have extreme repetitive accuracy, are not affected by vibration. Explosion-proof models available.

Diaphragm type sensing elements for vacuum and low pressure (to 120 psi), bourdon tube type for high pressure (to 12,000 psi), and piston type for high cycling rate (to 15,000 psi).

Wherever a Vacuum or Pressure change must initiate electrical action there is a Meletron or Barksdale Pressure Switch to perform that function.

For complete technical information see our catalog in Sweet's 1953 File for Product Designers and in the Plant Engineer's File, or write for catalog 2M-S.

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to prepare your entry for the APPLIED HYDRAULICS Prize Paper Contest. Start putting your material together and ask us for the Rules and Suggestions. Papers postmarked before midnight May 31st will be eligible for prizes.

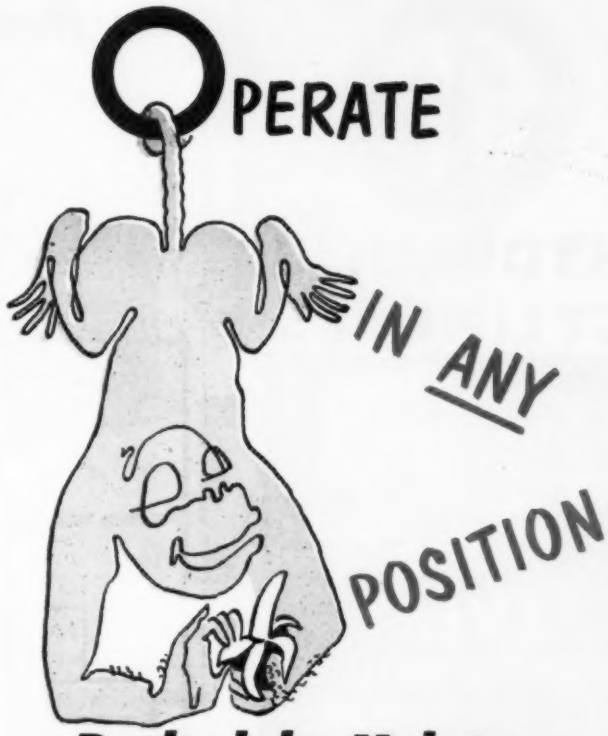
The liquid used to compress the nitrogen is one developed by the manufacturer which will not dissolve nitrogen and which does not congeal at the high pressures involved.

The compression process begins in the low pressure stage, using nitrogen supplied from regular gas storage cylinders. The hydraulic oil driven by the electric pump acts on a steel intensifier piston which displaces the special fluid into a "liquid piston" chamber, where the actual gas compression takes place. When the pressure in the low pressure stage reaches 15,000 psi a valve opens which permits hydraulic oil to pass into the high pressure stage of the compressor.

On the high pressure side the process is repeated, but at much higher pressures. Here the nitrogen is compressed from 15,000 psi to 100,000 psi. From here it is forced into a pressure "bomb," in which the actual experiment takes place.

This new compressor is a custom-made machine, constructed to the most critical manufacturing specifications by Harwood Engineering Company of Walpole, Massachusetts.

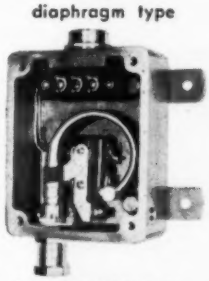
Metals used in it are special alloy steels, heat treated and inspected with great care. Nearly all parts of the compressor are finished by precision grinding. Before leaving the factory it was subjected to test pressures of the order of 165,000 psi, to insure a healthy margin of operating safety. The automatic gas compressor is an important tool for research and development in extreme high pressures—a relatively new field.



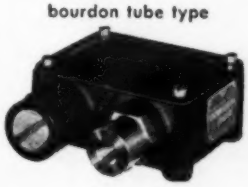
Barksdale-Meletron

PRESSURE SWITCHES

diaphragm type



bourdon tube type



piston type

have extreme repetitive accuracy, are not affected by vibration. Explosion-proof models available.

Diaphragm type sensing elements for vacuum and low pressure (to 120 psi), bourdon tube type for high pressure (to 12,000 psi), and piston type for high cycling rate (to 15,000 psi).

Wherever a Vacuum or Pressure change must initiate electrical action there is a Meletron or Barksdale Pressure Switch to perform that function.

For complete technical information see our catalog in Sweet's 1953 File for Product Designers and in the Plant Engineer's File, or write for catalog 2M-S.

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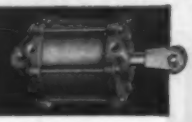

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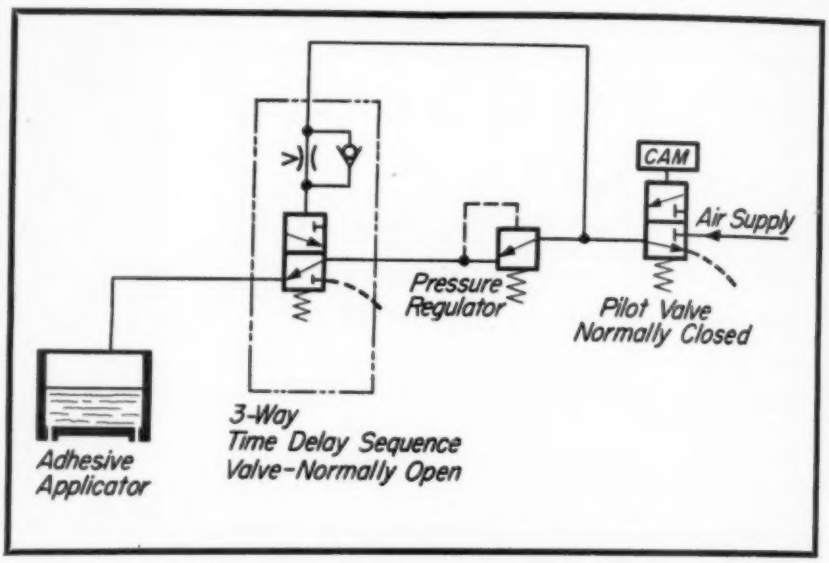
A Bassett Company

How Air Pressure Is Used To Apply Glue

By W. G. Deas

Henry M. Wood Co.
Cincinnati, Ohio

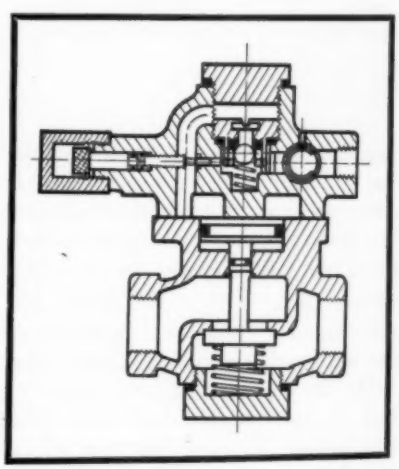


TIME OF GLUE flow is controlled by the 3-way time delay sequence valve.

ONE of our customers had the problem of regulating the flow of glue to a fabric gluing fixture. The fixture is mounted on an air press and the press is operated to bring the adhesive applicator down to the work. A section through the applicator, shown in the circuit sketch shows that the glue is fed by air pressure through many very small holes.

How can the quantity of glue which flows from the applicator be controlled? Will glue drip from the applicator when it is raised from the work? The simple circuit shown here has worked very well and provides quick and easy regulation of glue flow. A 3-way, normally open time-delay sequence valve is the key to the control. As the press hits the bottom of the stroke, it trips the normally closed cam pilot valve permitting air to flow through the 3-way normally open time delay sequence valve and to the applicator.

Just ahead of the regulator we teed off to the sequencing head of the time delay valve. With this circuit we get immediate air flow under controlled pressure to the applicator; and when air volume builds up in the sequencing head, the air flow to the applicator is immediately cut off. Air in the applicator chamber is exhausted to atmosphere. Glue flow is timed by the sequence head



CROSS-SECTION of the time delay sequence valve used in the glue applicator circuit.

Courtesy of Ross Operating Valve Company

in the time delay valve. A cross-section of this valve shows how an adjustable needle determines the volume of flow of the actuating air into the chamber above the piston of the valve.

Since time delay is controlled by volume flow rather than pressure, the time interval on this valve may be accurately set and maintained from zero seconds to 5 minutes. On the gluing job a very short time interval was used.

At one time we thought that a vacuum chamber might be required on the exhaust side of the time delay valve to reduce the pressure in the applicator and prevent the adhesive from dripping. In operation, we found that this was not necessary.

Important to the success of this application is the selection of the size of holes feeding glue through the chamber to the gluing channel, and the use of an adhesive having the correct viscosity.

Materials Handling Show

The National Materials Handling Exposition will be held at Convention Hall, Philadelphia, May 18-22. Three hundred companies will exhibit machines valued at over ten million dollars, using the entire facilities of Convention Hall. Thousands of devices will be shown for the first time. The Exposition is expected to attract over 25,000 visitors from 40 countries.

The Conference, conducted by the American Material Handling Society, which will be held for three of the five days, will provide seminars on: "Handling in Process"; "Warehousing and Shipping"; "Packaging for Improved Handling"; "Bulk Handling"; and "Requirements for Organization, Study and Analysis."

Lockheed Leadership Fund

The Lockheed Aircraft Corporation announces the establishment of an annual program to provide for 20 four-year scholarships to outstanding high school graduates. Cyril Chappellet, Lockheed vice president, in making the announcement, stated that fifteen colleges and universities, 10 of which specialize in science and engineering, will participate, each administering one new leader-scholarship annually.

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Shock-mounted for longer life.
Designed to meet J. I. C. specifications.
Four to 20 pounds push or pull. Stroke to one inch maximum. A. C. and D. C. models.
Special solenoid problems engineered to your needs.

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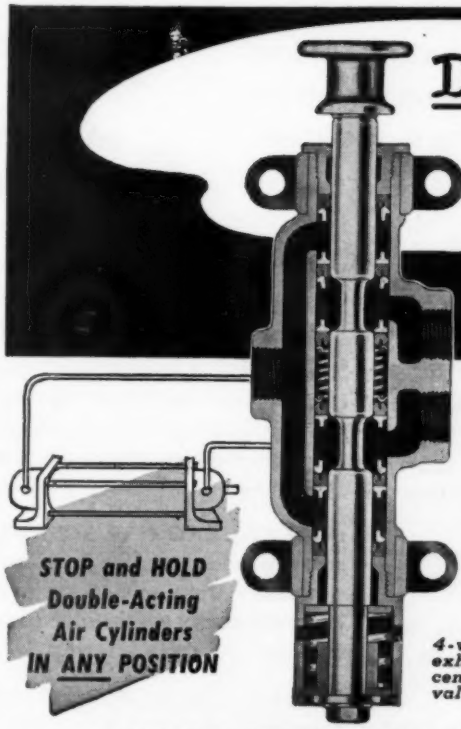
Diversatility
IN CONTROL OF DOUBLE-ACTING AIR CYLINDERS
Only VALVAIR offers 2 Kinds of Neutral Valves



STOP and HOLD Double-Acting Air Cylinders IN ANY POSITION

Manual or spring-return to neutral position are the two models by Valvair. Three types: (1) all ports blocked at neutral; (2) inlet and cylinder ports open to pressure, exhaust closed; (3) inlet closed, cylinder ports open to exhaust. 3-way and 4-way. Pipe sizes, 1/4" through 1". Six control assemblies: knob, lever, clevis, treadle, cylinder, solenoid.

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4-way, piped exhaust, spring-centered neutral valve.

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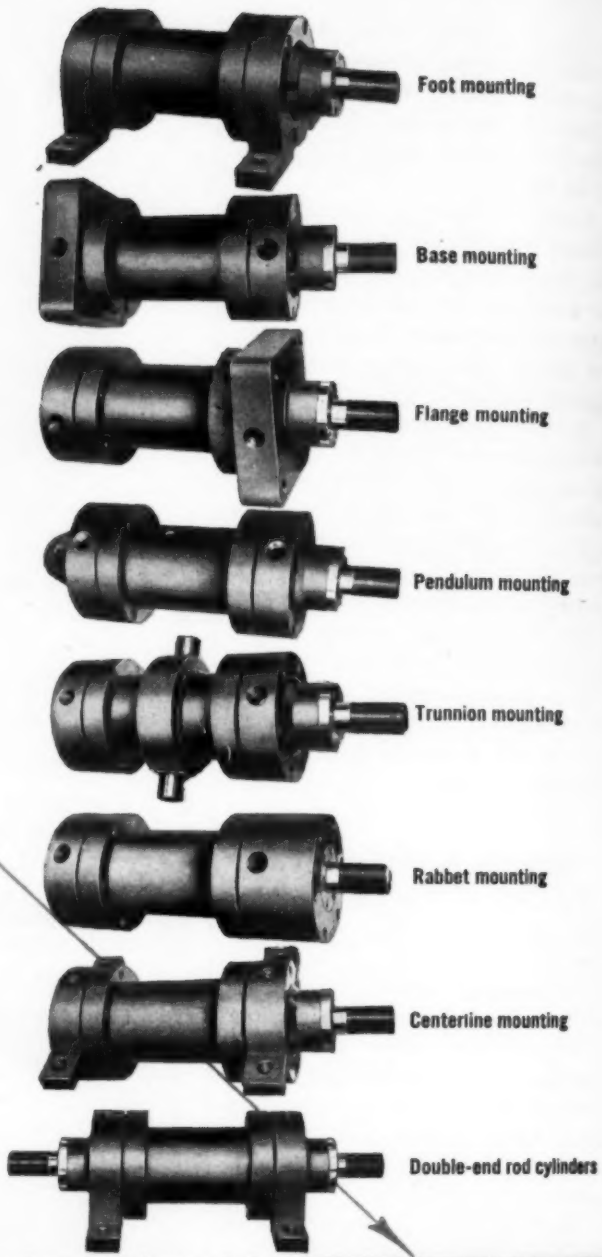
LINDBERG HYDRAULIC CYLINDERS

... now available for pressures to 3000 PSI

For extra power applications, it'll pay you to investigate the new Lindberg line of hydraulic cylinders for operation up to 3000 PSI ... ruggedly and heavily designed for extra performance. Added to the 1500 PSI hydraulic cylinders, this line gives you a selection from 0 to 3000 PSI ... and supplements the Lindberg line of air cylinders.



Check these Lindberg features for dependable, low cost power for lifting, forcing, pulling, pressing, pushing and clamping:

ROTATING CAPS ... Caps can be easily rotated in order to position ports for piping. Just remove cap screws, and revolve head cap ... it isn't necessary to disassemble cylinder. This feature permits simplified piping, and frequently eliminates need for T-fittings or elbows.

NO TIE-RODS ... Welded flange construction eliminates need for tie-rods ... insures proper alignment.

PACKING RESISTS OIL AND TEMPERATURE ... Chevron type piston rod packing is made of special asbestos cloth and rubber compound ... resists high temperature ... is not affected by oil.

NEOPRENE O-RINGS ... Conventional gaskets are replaced by Neoprene O-rings. Sealing action is automatic ... the higher the pressure, the tighter the seal.

SOCKET-HEAD CAP SCREWS ... All screw heads are in the open and easily accessible from outside the cylinder. It is not necessary to partially disassemble cylinder to tighten screws.

Lindberg 3000 PSI Hydraulic Cylinders come in 8 mounting types and 10 bore sizes from 2" to 8".

New 28-page bulletin

No. 701 carries detailed drawings of both 3000 and 1500 PSI cylinders ... chart-tables show bore sizes, pressures, etc., ask for your copy, today.

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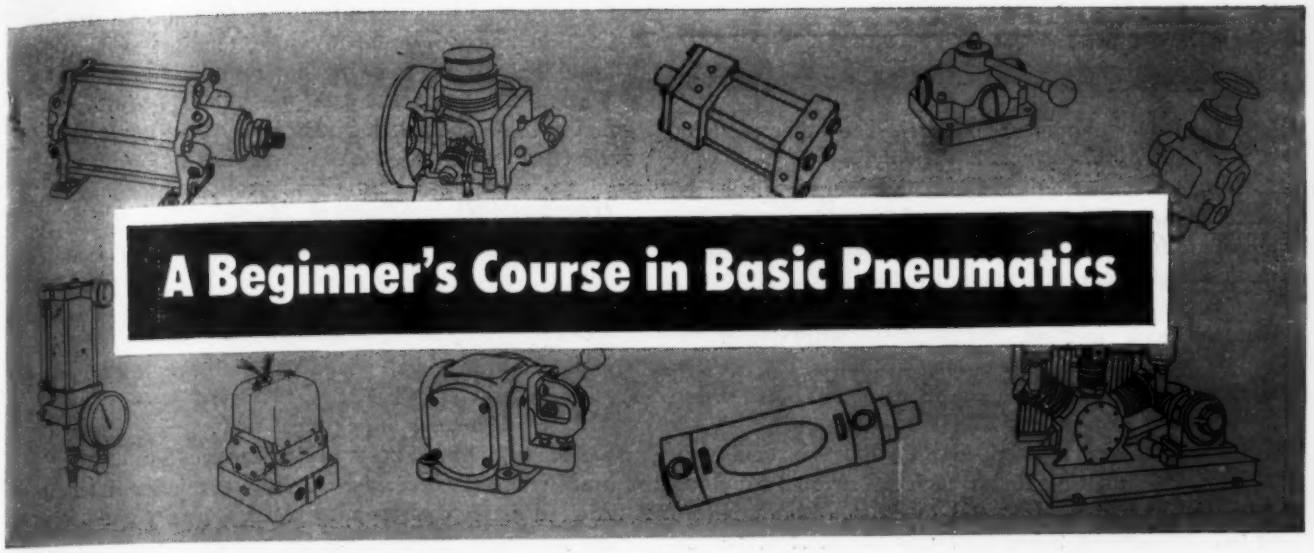


Section II The Distribution System

AIR HOSE

Part Seven

SEVERAL types of air hose are in general use for industrial applications. We will briefly sketch several of the most commonly used types and give a few basic features of the manner in which these hoses are made.

A wide range of hoses are offered by leading manufacturers, one manufacturer for example making over 100 different types of hoses for a wide range of purposes. Hose for air use are for the most part small in diameter and designed for relatively low pressures.

There are at least six types of hose construction, of which we will mention three. These three types cover practically all air hose now being made for industrial air applications. The three types of construction are: (1) wrapped hose; (2) horizontal braided; and (3) vertically braided hose.

Wrapped Hose

The building of hose by the wrapped process is the oldest of the methods by which hose is constructed. There are wrapped types of air hose, water and steam hose and many others. There are two methods for building a wrapped hose. The first of these is by extrusion. The slabbed stock is run through an extension die. The extruded tube

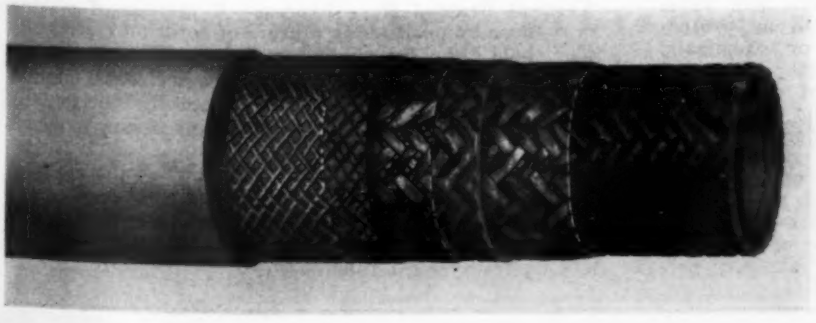


Fig. 1. TYPE 50 general purpose air hose, illustrating the two braid construction. Left to right are cover, breaker ply, cushion ply, braid of high tensile rayon cord, cushion ply, second braid and tube.

is slipped over a pole or mandrel. The other method is by lamination.

In the lamination method the gaged stock is wrapped around a pole or mandrel. This process is repeated for each ply of the finished hose. The smaller diameters are made by the extrusion process, larger diameters are made by the laminating sheeted stock method. Since it is impractical to handle poles or mandrels longer than 50 feet, the maximum uncoupled length of wrapped hose is 50 feet.

The carcass of a wrapped hose may be made up of cotton, synthetic fabrics such as rayon or nylon, asbestos, wire, flexible metal pipe or a combination of two or more of these. Cotton is the most commonly used fabric for this reinforcement. This fabric is impregnated with rubber or synthetic rubber and cut on the bias so that the cords in the fabric, built into the hose, form an angle of approximately 45 degrees with the axis of the hose. Commonly, the cover is also wrapped in a similar operation.

Wrapped hose has a number of advantages: (1) the inside diameter can be held to very close tolerances because it is made on a mandrel whose outside diameter is the same as the inside diameter of the hose; (2) a smooth surface is insured for the inside of the tube by the smoothness of the mandrel surface; (3) a large range of diameters is practical (hose from 3/16 inch to 36 inches); (4) almost any type of compound can be used both for carcass or cover; and (5) metal insertions (woven wire) can be made for types of hose whose service requires it.

As pointed out, there is a limitation of 50 feet in the length of wrapped hose. Fabric placed on the hose on a bias has a tendency to assume a straight position under internal pressure, tending to twist the hose. This is not true of horizontally braided hose. While not a serious matter for most industrial purposes, the cover of the hose bears the impression of the fabric with which it was wrapped to cure it.

Horizontally Braided Hose

Horizontally braided hose is made on a mandrel and combines the wrapped and braided processes of hose construction. Horizontally braided hose is made commonly with an extruded tube. The tube is placed on a mandrel and passed through a horizontal braiding machine.

This machine has a vertical plate and the mandrel passes through a hole in its center. Spool carriers are arranged circumferentially at regular intervals. A cord from each spool extends down to the hose. In operation, as the mandrel moves slowly through the braider, half of the carriers move in one direction, the other half in the opposite direction, placing a braid of cords around the tube.

After the braid is put on, the mandrel moves through a tank filled with cement, saturating the braid and insuring good adhesion for the next layer. A thin layer of sheeted rubber is placed over the braid before the next braid is applied. After the last layer of braids has been laid on the hose, a cover is wrapped on and the hose cured.

With the horizontal braiding method of construction, the angle at which each cord is laid on the hose can be controlled within very close limits. This means that the hose strength is uniform throughout. Such hose is much lighter than wrapped fabric hose for equal service. Another advantage is that horizontal braided hose does not tend to twist under pressure, since for each cord pulling diagonally in one direction, there is another cord

Hose Nomenclature

Breaker—A ply of open braid or loosely woven fabric, usually applied between the carcass and cover to strengthen the adhesion of component parts. It may be used between the tube and carcass for the same reason.

Carcass—The supporting structure of hose between tube and cover. It may be cotton, synthetic fiber, asbestos, wire, etc., and woven, braided, wrapped or spirally wound.

Cover—The outside covering element of a hose, the purpose of which is to protect the carcass from abrasion or other destructive forces, e.g., pulsating pressures, sharp falling objects, sun rays, oxidation or weather aging as well as protection against oils, greases, acids or chemicals.

Horizontal Braided Hose Process—A method of making hose by positioning a braid of cords on a horizontally mounted tube by means of counterrotating carriers mounted circumferentially on a vertical circular plate.

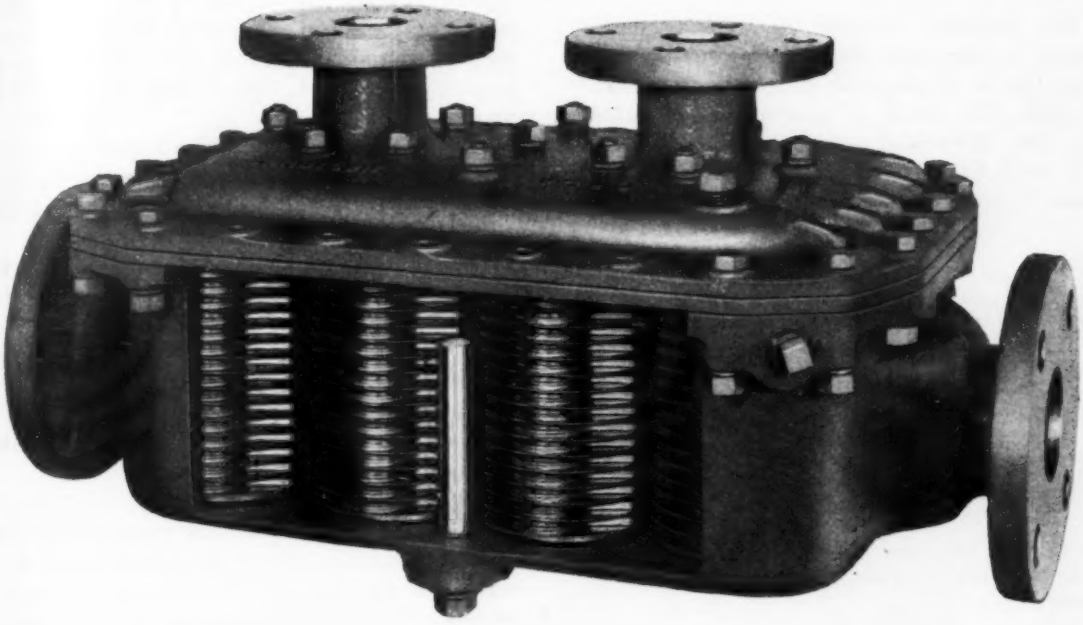
Pressures—The three classes of pressures commonly referred to in connection with hose are:
(1) Recommended Working Pressure—the pressure at which a given size and type of hose may be operated safely, give its most satisfactory performance and service life.
(2) Test Pressure—the pressure that a hose is guaranteed to stand. For hose the understanding usually is the pressure a hose will withstand if tested within 30 days after delivery and before being placed in service.
(3) Burst Pressure—The pressure point, determined by laboratory tests, at which the hose is ruined and unfit for further service.

Tube—The lining or that part of a hose that comes into actual contact with the fluid or material being conveyed.

Vertical Braided Hose Process—A method of making hose by positioning a braid of cords on a vertically held tube by means of counterrotating carriers mounted circumferentially on a horizontal circular plate. This method differs from the horizontally braided process in that it is not necessary to mount the tube over the mandrel.

Wrapped Hose Process—A method in which hose is made by stretching an extruded tube over a horizontal mandrel and building up the carcass of the hose by wrapping calendered sheets in successive plies over the tube.

HARRISON OIL COOLERS



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Expensive hydraulic equipment must *produce* in order to *pay its way*—and only an oil cooler that is designed for the equipment it is to serve will help keep that equipment producing, day after day.

In back of every Harrison oil cooler is more than forty years' experience in designing heat transfer equipment for industry. This experience, combined with Harrison's complete facilities for testing and manufacturing, results in the proper oil cooler for each job.

Why not use our experience and facilities to find the *right* oil coolers for *your* equipment?

HARRISON RADIATOR DIVISION

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HARRISON

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pulling with equal force in the opposite direction.

Vertically Braided Hose

Tubes for vertically braided hose are produced by extrusion in the same manner as for wrapped hose except that it is prepared in lengths up to 500 feet in length. The braid is applied by a braider similar to the horizontal braider except that no mandrel is used. For this reason the plate that holds the carriers is mounted horizontally and the tube goes through the braider vertically.

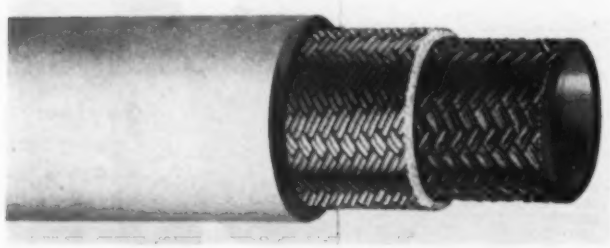
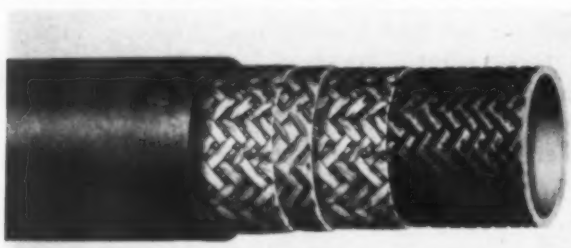


Fig. 3. A LOW COST hose, the Maxecon all purpose, two ply air hose has a cushion between two braids of rayon cord.

Fig. 2. A SINGLE BRAID, light flexible hose, the Highflex air hose has only cover, a single braid of multiple strands of high tensile strength cotton or rayon cord and the tube in its construction.



Vertical braiders are equipped with 24, 36, 48, or 64 carriers each of which may carry one, two or three strands of cord. In this way an almost endless number of combinations is possible.

The manufacturers of air hose offer a number of types; some are designed for a specific set of service conditions, some are constructed to give one or more particularly desirable features, others are constructed for general service. We can get a good idea of the types of air hose in common use in industry by describing leading hoses made by three representative manufacturers.

Goodrich Air Hoses

The B. F. Goodrich Company line of air hoses includes the Type 50, a general purpose, the Highflex, a light, flexible, and the Maxecon, a low cost hose, all braided types.

Type 50 air hose, shown in Figure 1, a general purpose hose, can be used to handle 85 percent of all air hose needs. Two or three braids (2 for the sizes to ½ inch) of heavy, high tensile rayon cord are used with a special coating bonding the cord to both tube and cover. A cushion ply of friction rubber coating is applied between the layers of fabric reinforcement, insulating the braid, increasing flex life and eliminating ply separation. Working pressures are high enough to take care of practically all surge loads under normal conditions.

The tube is built to withstand heated air and will not break into loose or gummy particles to clog tools. An oilproof cover is highly resistant to cutting, abrasive and sun-checking action.

The Highflex air hose is a single braid, light, very flexible hose. Available only in small sizes (3/16 to ½ inch) this type is recommended for bench work and small shop tools. It can be used for water, lubricating oil or as low pressure hydraulic hose. The single braid is made of multiple strands of high tensile strength cotton or rayon cord. Figure 2 shows the construction of this hose.

The Maxecon is an all purpose hose, one or two braid (high tensile strength rayon cord) low cost hose. In addition to air, it is constructed to handle water, oil, gasoline and welding gases in shops or out of doors. The two braid type, as shown in Figure 3, has the same type of cushion ply between the braids as built into Type 50.

All three types of Goodrich air hose described are available in continuous lengths on reels.

U.S. Air Hoses

U. S. Royal Cord air hose is a two ply, lightweight, super-flexible molded air hose especially recommended for long air lines, e.g. applications in quarries, mines or in road work. An open-braid ply anchors the oil resisting tube to the cord carcass. A tough, thick, wear-resistant cover offers unusual resistance to external blows or bruises caused by blasting, by heavy tools falling on it or by vehicle wheels passing over it.

U. S. 4810 air hose, designed to handle high pressures and the most severe abrasion and abuse, is recommended for pneumatic tool (two braid) and air drill applications (three braid). A thick, tough cover of resilient rubber protects the carcass and at the same time makes the hose easy for the worker to handle.

U. S. Rainbow molded air hose is a general utility hose of two braid high strength rayon. Available in continuous length construction, the hose is available in sizes ½ to 1 inch, all sizes at recommended working pressure of 175 psi.

Gates Air Hoses

Type 8B light duty air hose made by the Gates Rubber Company is available in small sizes (¼ to ½ inch) one or two braids in each size. This type is recommended for pressure gage connections, small air tools or other light duty air applications.

Type 14W is a wrapped type air drill hose. Made in four or five plies of rubber impregnated duck fabric, this type offers both great strength and high resistance

Looking for a more efficient piston design?

. . . These Johns-Manville Custom-Moulded Packing cups increase piston efficiency . . . save space . . . save power . . . serve longer

TYPE A . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.

TYPE B . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, Box 60, New York 16, N. Y.

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Johns-Manville PACKINGS & GASKETS

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ORIGINATOR OF **MICRONIC** FILTRATION

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Ribbon

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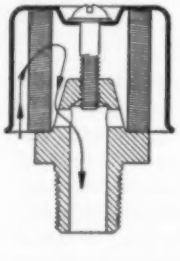
IN SIZES FOR EVERY APPLICATION

This compact, new ribbon element filter is available *for the first time* in three sizes—¼", ½", ¾" pipe thread, thus meeting the needs of every application.

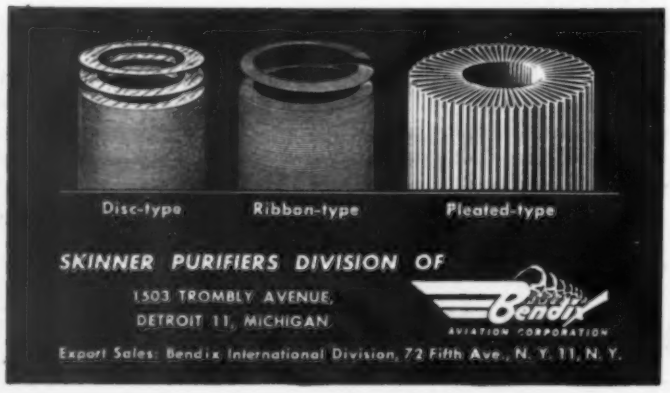
Positive Controlled Filtration. The specially designed element offers *greater efficiency than any air vent filter on the market*—approximately 40 micron filtration (.0016").

Lasts as Long as the Equipment. Although it costs little more than a quart of oil, *this ingenious filter will never wear out* . . . and is easily cleaned.

Hundreds of Uses. The new ***Bendix-Skinner*** Air Vent Filter has literally hundreds of applications. For example, hydraulic systems . . . air compressor intake . . . carburetor intake for small gasoline engines . . . crankcase ventilation . . . pneumatic cylinders . . . fuel tank breather . . . pneumatic instruments . . . immersion or sump filter.



Write Dept. B for complete details on this revolutionary new filter.



to pressure. The thick, non-porous tube will not flake or chip off; the tough rubber cover is designed to withstand abrasive conditions. It is recommended for service with vibrators, jackhammers, air drills or similar air applications where a wrapped hose is desirable.

Type 14B is a braided type air drill hose. Made in two and three braids of extra strong cords woven at the locked angle, hose distortion under pressure is reduced to an absolute minimum. Type 14B is recommended for pneumatic drills, air clutch connections, heavy rivet hammers, pavement breakers and other industrial air applications. This hose is of vertically braided construction.

The next installment will give hints on the care of air hose to insure long, efficient life.

Unusual Press Design

Concluded from page 82

cumulators to a pressure of 3000 psi by use of a compact, twin piston hand pump capable of developing 5000 psi. The pump is complete with a gallon capacity tank and pressure release valve. Once the system is filled and the accumulators charged the hand pump is only used to makeup leakage. Two short 1 inch extra heavy pipe lines, one from each accumulator to a cylinder, carry high pressure oil. Pump to accumulator connections are made with ¼ inch extra heavy pipe.

The machine is expected to displace many devices now used for crushing, grinding, macerating, blending and compounding to improve results obtained by present type rolling mills, ball mills, hydraulic presses and decorticating machines.

Multiple Clamp Circuits

Concluded from page 68

of horizontally placed cylinders. This hydraulic clamp unit is used wherever clamping in a horizontal plane is required and only one side of the part can be reached for holding purposes.

3. Double side horizontal clamping is best used wherever the part can be held from two sides and whenever the parts are small enough to be nested in the machine and held in pairs.

This clamping equipment is interchangeable from place to place, and it is possible to operate a row of double side clamps as a basic unit and a row of single side clamps as a basic unit, or a combination of one vertical clamp in between every 9 inches. Or the vertical clamps can be operated at intervals of 18 inches and can be operated as a basic row of clamping.

Designers of this clamping arrangement endeavored to provide suitable clamping movement for every type of operation and to make it possible for interchangeability of clamping units which reduce the number of units that must be kept on hand for all operations.

Circle 14 on Reader Service Card

Improve Your Handling Equipment

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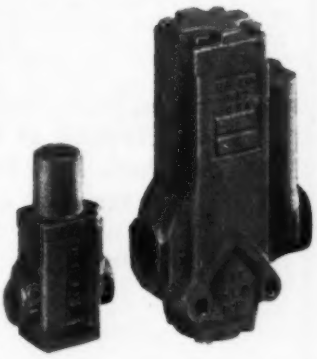
HYDRAULIC Flow Control Valves



Increase stability and safety of your lift and straddle trucks. BHEW Flow Control Valves *automatically* control load descent rate at predetermined speed, heavier the load the slower the lowering rate! Eliminate surge at start of descent. No restrictions on load lift speed or empty fork movement. Models for all size trucks, for attachment or O.E.M. applications. Write for detailed, illustrated literature.

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All types and sizes of standard and especially designed cylinders for tilts, hoists, clamps, shifters. Cylinders have small O.D., need minimum mounting clearance. Available for any mounting you desire. Have honed barrels, plated rods, non-adjustable glands. Send specifications of *your* application to

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HYDRO-WYPES protect "O" or "V" rings, cylinders and other working parts by wiping piston rods clean of dust, dirt, shavings, ice and other foreign materials. Widely used by manufacturers to prolong the life of hydraulic or pneumatic components in lifts, presses, drills, grinders, aircraft and marine controls, dump trucks, road graders, railroad equipment, etc. Approved MIL-S-5049. Write ATSCO for catalog and details.

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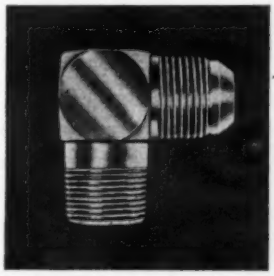

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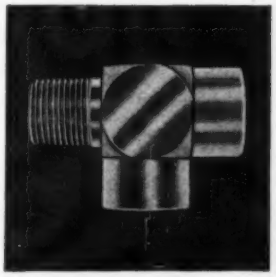
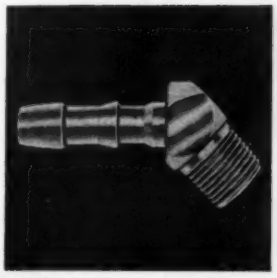
- Variable Length Elbows
- Lateral Tube or Pipe Outlets
- Bulkhead Straights – Elbows



PIPE FITTINGS

- Steel-Bar Stock
- 3000 PSI Service
- Dryseal Pipe Threads
- Elbows, Tees, Crosses, Unions, Bushings, and Nipples



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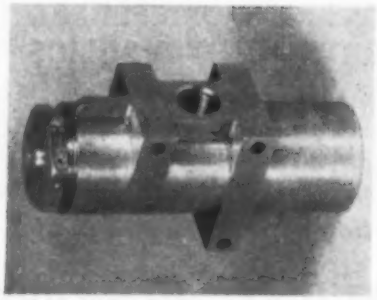
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 26



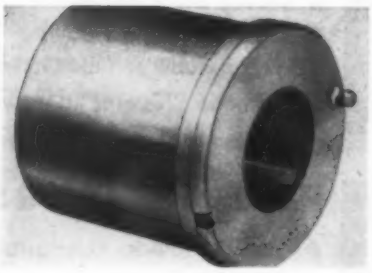
PRESSURE RELIEF VALVE
. . . has one moving part

Sizes: Produced in both aircraft and standard pipe sizes.

Design: Less than a dozen parts, the valve will relieve and equalize excessive pressure of oil, water or chemicals to a predetermined setting. Despite changes in demand it maintains proper pressures. At the same time it protects pumps by allowing flow through the pump. The valve seat is formed of two hardened steel pieces which are designed, ground and lapped for long life. There are no restricting parts to affect movement or operation as pressure increases.

Anco, Inc.
Providence, Rhode Island

Circle 158 on Reader Service Card



PILOT BUSHING
. . . for needle bearings

Sizes: Available in shaft diameters from ⅜ to 2 inches.

Features: Provides an absolute seal against dirt, coolants and grit entering the bearing cavity. The effectiveness of the needle bushing seal is actually increased as dirt, coolants and grit enter the outer seal. These bushings permit closer center distances than roller bearing type bushings. Can be disassembled without removing the housing; protect against thrust loads as well as radial.

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Cleveland, Ohio

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FLUID COUPLING
. . . uses silicone fluids

Sizes: From ¼ hp to 4 hp at 1800 rpm.

Features: Operating by an entirely new principle, coupling is compact, trouble proof and leak proof. No larger in diameter than the standard motor and adding but ¼ inch in length to the motor, unit is furnished complete with flexible coupling for attaching to driven shaft, or with V-belt pulley.

L & S Industries
Norwalk, California

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AIR PUMPS
. . . have oil-free design

Capacities: Six models are available with capacities from 0.5 to 5.0 cfm.

Design: The pump operates absolutely dry. Carbon-graphite composition blades and thrust plates are self lubricating. The pump rotor and four sliding blades are the only moving parts and they take up for wear automatically. Pump impeller parts are assembled on the end of the motor shaft, therefor no pump bearing is used. The integral assembly of pump and motor provides accessibility to all parts through the pump end.

Romec Division, Lear, Incorporated
Elyria, Ohio

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Success Story!

Ferber Corp. of Englewood, N. J. in building its own hydraulic printing presses to imprint its nationally known line of Presdon Vu-Riter pens, had a tricky packing problem. They tackled it—licked it—and presented another example of how Palmetto G-T Rings give better answers to tough packing assignments.

Rod had to be Oil Free...

Ferber's press had a chrome plated ¼" piston rod reciprocating 144 strokes/min.; Working Pressure—550 psi; Hydraulic Medium—"Sunvis" 916; Temperature—approx. 150 F. Oil, if carried on rod, would contaminate stock and interfere with printing . . . *therefore rod must be free of oil.*

PALMETTO G-T Rings the Answer...

Other type packing rings were tried but when results were not satisfactory, glands were modified to accommodate Palmetto G-T Rings. After *6 months without maintenance*, Ferber installed Palmetto G-T Rings in *four more machines with equally good results.* (NOTE: Each of these rods "travel" nearly 9 miles in a working day!)

What's your problem?

Palmetto G-T Rings are recommended for use as seals in hydraulic and pneumatic cylinders and valves, welding machines, hydraulic steering gears, control units, testing equipment and in applications where simplification of design and weight are prime factors. Extrusion of the packing material is eliminated. Where can Palmetto G-T Rings help you?

Write for your complimentary copy of the new Greene, Tweed manual. This helpful 32-page handbook for the design engineer covers Palmetto G-T Packings in detail—as well as other noteworthy Palmetto Molded Packings.

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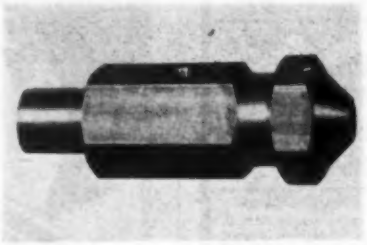
New Products

Continued

AUTOMATIC DRAIN VALVE

Designation: C-1.

Features: Device works on a new vapor ejection principle. Operating by air pressure from the control or unloader pipe, the valve acts every time the compressor starts, stops or unloads. Collected water is atomized as it is ejected so that it



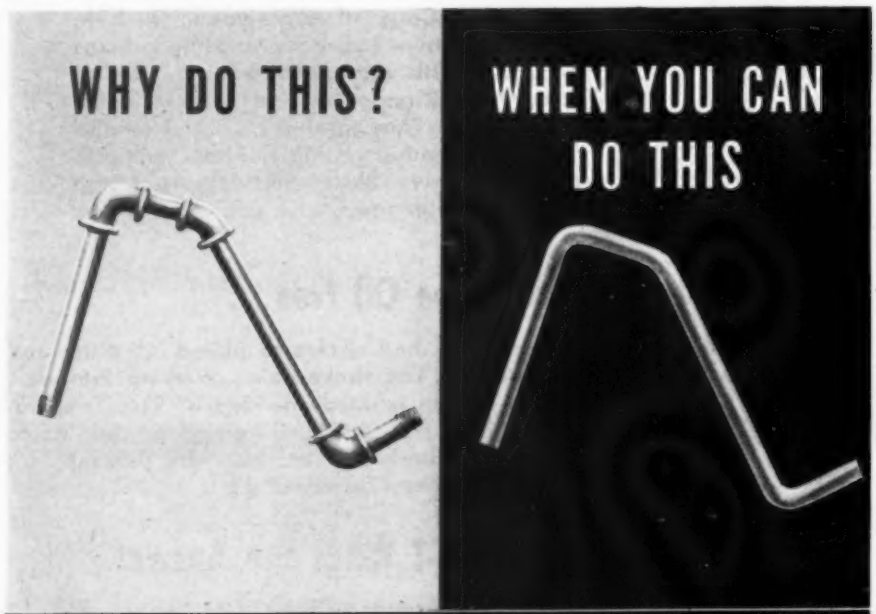
evaporates as it leaves the valve. Completely eliminates the need for drip pans, drain lines or sewage connections and requires no manual attention.

Operation: Air pressure in the reservoir holds a piston in retracted position when the operating line is vented. When the compressor starts, the control line builds up pressure, moving the piston valve to extended position. When the compressor stops or unloads, the control line is vented, returning the piston to retracted position. As it moves between retracted and extended positions, collected moisture is vapor-ejected as an exhaust groove passes over the exhaust holes.

Application: Installed on air compressors to remove water automatically as quickly as it collects.

Westinghouse Air Brake Company
Wilmerding, Pa.

Circle 162 on Reader Service Card



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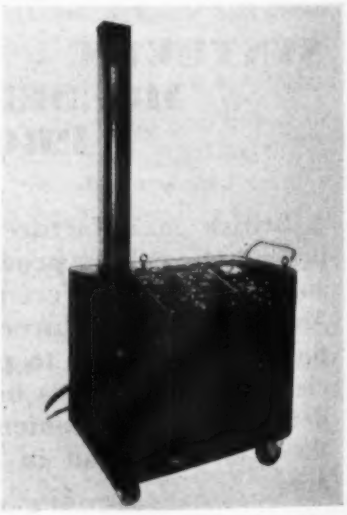
LEAK TEST UNITS

Designation: Portable Manometer Leak Test Machine Model 14-4

Features: Operating on the fall-in-air-pressure principle, these units are suited for detection of the most minute leaks in fluid systems. Developed initially for final tests in assembled aircraft



fuel and hydraulic circuits as well as pressurized cabin systems. May be used on other critical leak detection requirements found in nuclear, automotive, marine and process industries.

Operation: Adjustable through the range 0 to 20 psi within 1 inch H_2O and repeatable within

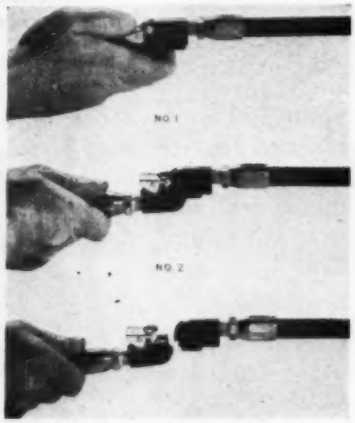
2 inch H_2O. Air pressure regulation is provided through pilot loaded free diaphragm regulators, one being for pressure reduction, the other for relief. Manual by-pass valve for rapid filling of receptacle to be leak tested is provided.

Devic Engineering Company
Philadelphia, Pa.

Circle 163 on Reader Service Card

SLIDE SEAL COUPLING

Design: Consisting of two simple 2-piece die-cast aluminum assemblies with rubber O-rings. A spring actuated locking device holds each half of the coupling in the coupled position Pressing the lock lever sepa-



rates the coupling halves and starts the disconnecting action which is completed by a light pull. When fully disconnected, each half forms a perfect seal.

Features: Permits instant connection and disconnection of fluid carrying lines by means of a simple push-pull action. Is extremely lightweight and very compact.

Applications: Handle wide range of fluids such as hydraulic oil, water, hot oil, crude and fuel oils, and used on engine test stands, drilling rigs, pneumatic gun charging systems and air tools.

Aeroquip Corporation
Jackson, Mich.
Circle 164 on Reader Service Card

HIGH PRESSURE CONTROL VALVES

Designation: Model CO.

Sizes: Offered in a variety of horsepower and flow ranges for

Circle 81 on Reader Service Card

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leak proof
AIR VALVE
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(Valve Alone)
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Complete Assembly Includes Valve, Mounting Rods, Operating Cam
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Automatic END DUMP
Item C-465
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Item S-911
BARREL TRUCK loads automatically
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Item C-681 (Hood)
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Item B-768
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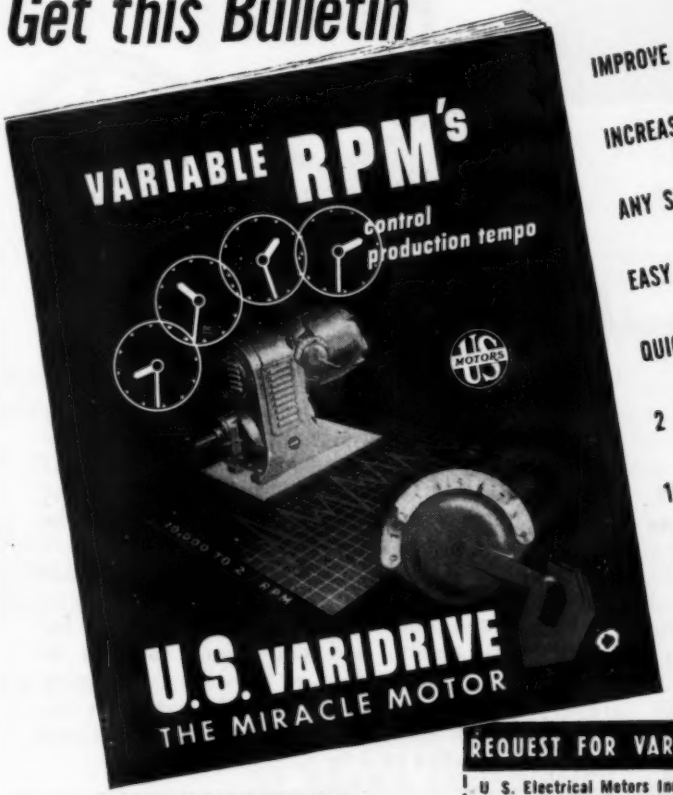
SHOVEL TRUCK
Palmer-Shile Co.
16052 FULLERTON AVE., DETROIT 27, MICH.



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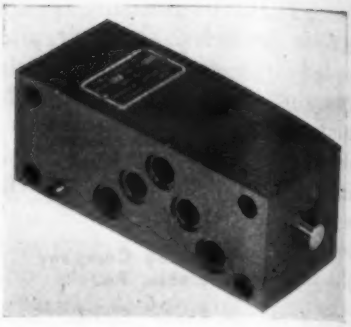
Circle 121 on Reader Service Card

Continued

system pressures up to 3000 psi.
Construction: Nitralloy moving parts are used to insure long service life and smoothness of operation. Pistons are lapped to bores to minimize internal leakage.
Features: Mechanically operated; the valves feature linear flow output and precision adjustment of piston land and sleeve port spacing for optimum neutral position characteristics. Where small forces are available to actuate the valve, valves may be obtained in which normal stroking forces have been substantially reduced so that



only light spring forces are required to maintain the piston in contact with the driving cam.

Hydraulic Controls Co.
Roxbury, Mass.
Circle 165 on Reader Service Card

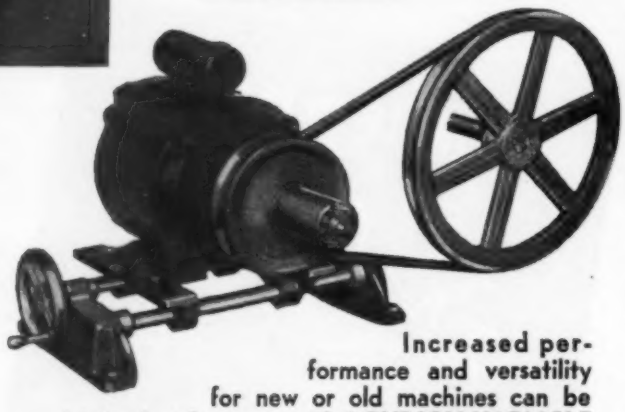
increase machine performance...

with

LOVEJOY

Variable Speed

PULLEYS



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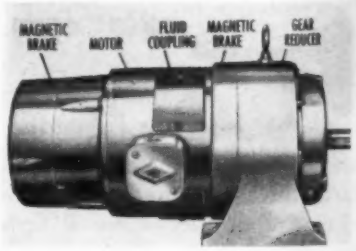
Also mfrs of Lovejoy Universal Joints, Flexible Couplings and Variable Speed Transmissions

FLUID-SHAFT MOTOREDUCER ... has individual deceleration and holding brakes

Design: Consists of a magnetic brake, motor with internal fluid coupling, a second magnetic brake and gear reducer. Purpose is to provide fluid-cushioned stops, as well as starts, with the added advantage of a holding brake.



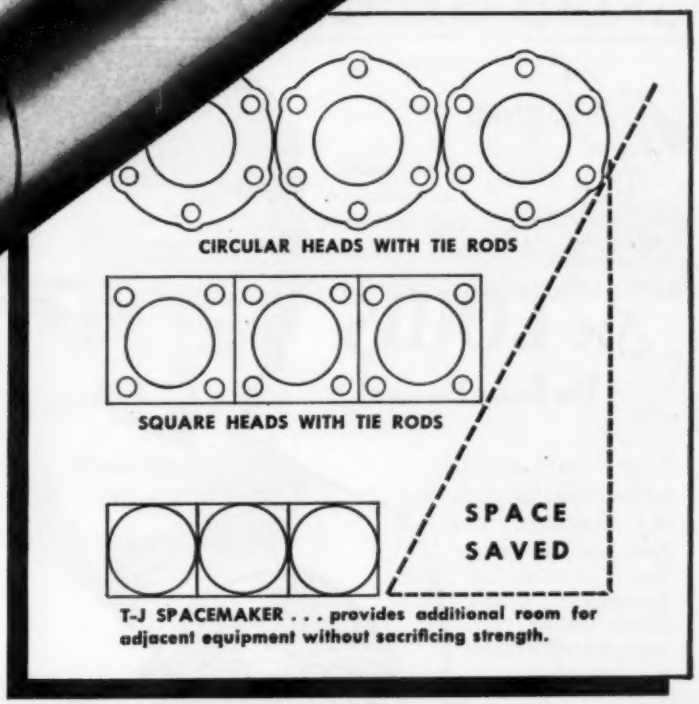
Operation: The energized motor transmits power smoothly to the load through the fluid coupling; after travel, the load is decelerated smoothly through the fluid coupling by the magnetic brake mounted on armature; at this point, load can be held stationery by application of second brake mounted between coupling and gear reducer.

Reuland Electric Company
Alhambra, California
Circle 166 on Reader Service Card

AIRCRAFT COMPRESSOR ... powered by hydraulic motor

Design: Compressor pumps 4 scfm at 3000 psi discharge pressure. It has two sets of three compression stages in parallel

NEW T-J Spacemaker AIR CYLINDERS



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

- SAVES UP TO 40% SPACE WITH NEW STREAMLINED DESIGN.
- SUPER STRENGTH . . . EXTRA HIGH SAFETY FACTOR
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- HEAVY WALL, PRECISION HONED, HARD CHROME PLATED, SEAMLESS STEEL BODY
- LEAKPROOF CYLINDER HEAD TO BODY CONSTRUCTION.
- RELATIVE PORT POSITIONS MAY BE ROTATED WITHOUT DISASSEMBLY OF CYLINDER AND LOCKED IN DESIRED POSITION.
- HEAVY DUTY, HI-TENSILE, HARD CHROME PLATED PISTON ROD.

Streamlined construction of the new T-J Cylinders *eliminates tie rods . . . reduces head size . . .* and *saves up to 40% in mounting space!* In addition, a new high in strength is achieved with solid steel heads and heavy wall seamless steel body . . . leakproof construction . . . extra high safety factor.

Cylinder walls are precision honed and hard chrome plated for long-life efficiency. Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . both cushioned and non-cushioned . . . for wide range of pushing, pulling, lifting, clamping or control jobs. T-J dependability. *Fast delivery* to meet rush requirements. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE

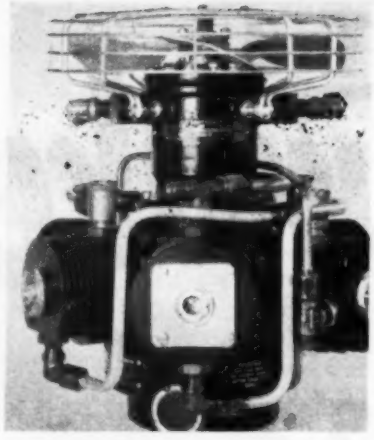
Many More Advanced Features!

T-J **TOMKINS-JOHNSON**

RIVITORS . AIR AND HYDRAULIC CYLINDERS . CUTTERS . CLINCHORS

for a total of six cylinders. It is powered by an integral hydraulic motor and can be furnished with a motor suitable for either 1500 psi or 3000 psi system.

Sizes: For a 1500 psi pneumatic system, the hydraulic fluid flow rate is 6.7 gpm at 1000 psi hydraulic pressure. For a 3000 psi pneumatic system, the hydraulic fluid rate is 3.3 gpm at 2000 psi hydraulic pressure. The total weight of the compressor including hydraulic motor and integral oil reservoir is 18 pounds.



The Cornelius Company
Minneapolis, Minnesota

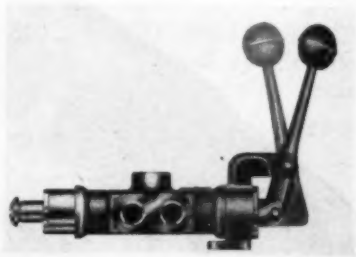
Circle 167 on Reader Service Card

AIR VALVE
. . . with built-in speed controls

Sizes: Available in a standard 4-way piped exhaust model; production currently in the ⅜ inch pipe size.

Design: Two speed controls built into the valve body.

Features: No purchase or installation of separate speed controls; simpler piping than usually required with separate speed control units. Control assemblies to actuate the valve are: knob, lever, clevis, treadle, foot, cam, cylinder, solenoid, and diaphragm.



Application: Principle use is to control the stroke of an air cylinder.

Valvair Corporation
Akron, Ohio

Circle 169 on Reader Service Card

THERMAL SWITCH
. . . protects hydraulic systems

Size: 2¼ by 1⅛ inches.

Design: Of cartridge type, is constructed to screw into a ⅜ inch hole in the equipment housing, bringing the temperature sensitive element in contact with the internal temperature conditions. Operates with a bimetallic element which may be set to function at temperatures up to 300 F.

Applications: Switch is applicable to fluid, vacuum and hydraulic systems, gas and diesel engines, air compressors, electric motors and various machines.

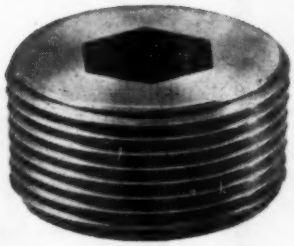
Eco Engineering Company
Newark, New Jersey

Circle 170 on Reader Service Card

Goshen Rubber presents
RING CHAMPS to remember!
HE OWNED AN EXPLOSIVE RIGHT HAND PUNCH
JOE LOUIS
"The Brown Bomber"
~JOE'S FIRST IMPORTANT VICTORY CAME IN 1935 WHEN HE SLAUGHTERED PRIMO CARNERA... HE LIFTED THE TITLE FROM JIM BRADDOCK 2 YEARS LATER AND HELD IT UNTIL HIS RETIREMENT IN 1949 !!
—A FAST, ACCURATE, CALCULATING PUNCHER, HE DROPPED MANY AN OPPONENT WITH ONE SMASH—
In this Corner... the "O" RING CHAMP
GRC "O" RINGS ARE INVINCIBLE AGAINST HIGH STATIC PRESSURES, HEAT, FRICTION, SHOCK, SURGE AND VACUUM...
WRITE TODAY FOR FREE GRC "O" RING HANDBOOK
HIGH SPOT IN JOE'S RING CAREER CAME IN HIS SECOND MEETING WITH MAX SCHMELING... HE BELTED THE GERMAN OUT IN LESS THAN A ROUND!
Goshen Rubber Company INC.
MOLDED • DIE CUT • LATHE CUT RUBBER SPECIALTIES SINCE 1916
1553 S. TENTH ST.
GOSHEN, INDIANA

Circle 107 on Reader Service Card

UNBRAKO®



dryseal-thread
PRESSURE PLUGS

seal tight
without compound

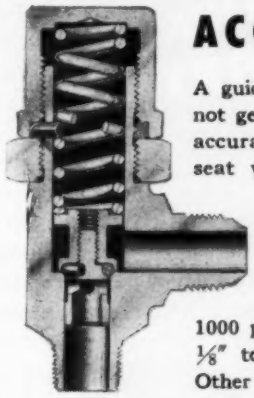
When UNBRAKO Pressure Plugs are tightened, major and minor diameters are positively sealed, pressure tight without sealing compound. UNBRAKO Dryseal-Thread Pressure Plugs, in a full range of sizes from ⅛" to 1¼" NPTF, are available from your local UNBRAKO distributor's stocks. Write for literature. SPS, Jenkintown 2, Pa.

Our Fiftieth Year : A START FOR THE FUTURE

UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

Circle 93 on Reader Service Card

REPUBLIC
VALVES
INDUSTRIAL • CHEMICAL • AIRCRAFT



ACCURATE RELIEF

A guided piston that cannot get out of line assures accurate relief, and long seat wear. High quality springs make settings permanent. Angle type — brass, or aluminum alloy; In-line type — steel, or aluminum alloy. Pressure settings to 1000 psi. Metal-to-metal, or "O" ring seal. ⅛" to 1" pipe, AN, or JIC connections. Other sizes and materials to order.

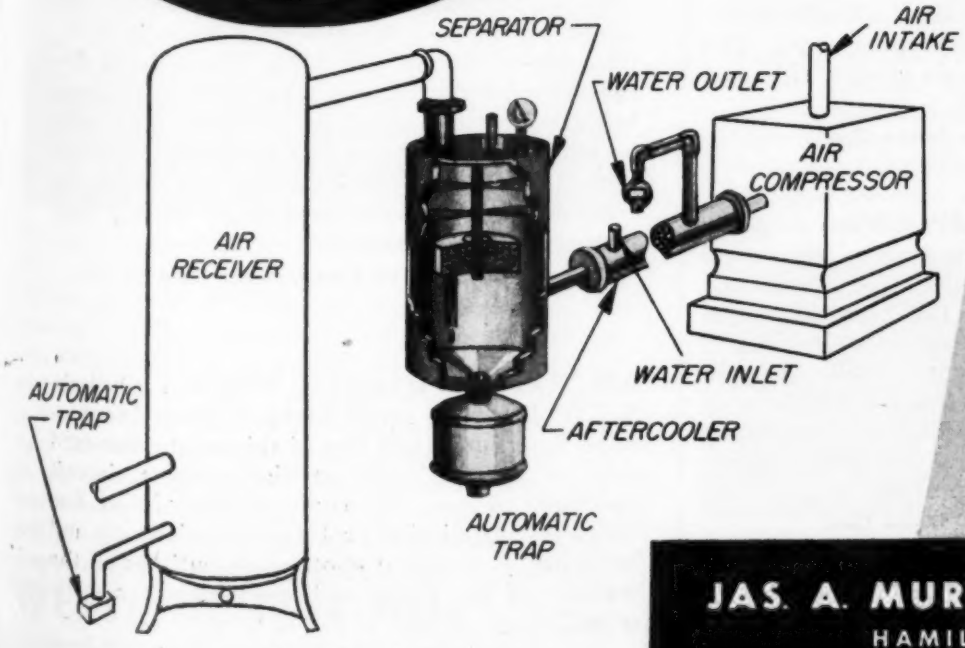
Write for complete catalog and nearest distributor.

CHECK RELIEF PLUG GLOBE NEEDLE

RM REPUBLIC MANUFACTURING CO.
1930 WEST 77TH STREET • CLEVELAND 2, OHIO

A GOOD RESOLUTION: *"Moisture Free in '53"*

MURPHY'S AFTERCOOLER SYSTEM



- COOLS
  Within 10°F of cooling water
- CLEANS
  Impurities out of air lines
- DRIES
  Last vestige of moisture
- RESULT
  Production without interruption

JAS. A. MURPHY & CO., INC.
HAMILTON, OHIO

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 44

SOLENOID VALVES . . . Automatic Switch Co. has issued a most comprehensive valve catalog, No. 24. The catalog covers valves made in packless and packed construction for all classes of service for which solenoid operated valves are suitable. The catalog is divided into ten sections, covering such lines as manual reset electrically tripped and no voltage release valves, packless, full pipe area solenoid operated valves for general purpose applications on air, gas, water, oil, steam, etc. There are details on midget and small size valves, two and three way pilot operated valves, four-way packless valves direct solenoid operated. Each valve described is illustrated, sectional drawings shown and complete specifications listed. Flow charts, general information and instructions on valve selection are included. Section ten of this useful catalog discusses strainers and filters which are also manufactured by this company.

Circle 218 on Reader Service Card

LIQUID LEVEL GAGES . . . Jerguson Gage & Valve Co., has prepared a 4 page bulletin describing the Reflex type liquid level gages. They clearly and accurately indicate the level in tanks, boilers or any liquid-containing vessel, and are used where a rugged, simply constructed high grade gage is desired. Errors in level reading are avoided because the liquid shows black, with a sharp clear line showing the level, a bright mirror like appearance in the empty space above. The gages are built in four pressure groups, sizes and specifications given for each.

Circle 219 on Reader Service Card

PLASTIC SEALING COMPOUND . . . Graycote, a plastic sealing compound to stop spiral leakage is described in Bulletin 37A issued by Chicago Gasket Company. The compound contains extremely fine powdered lead, suspended in a special non-soluble lubricant. It will adhere to almost all metals and gasket materials. It brushes on smoothly and quickly, having the consistency of thick paint. The bulletin outlines all its features and lists recommended applications.

Circle 220 on Reader Service Card

ELECTRICAL CONTROLS . . . Comar Electric Company has prepared a folder of catalog sheets describing their line of transformers, coils, relays, interlocks, switches and solenoids. Each sheet gives dimensional data, construction details, mounting specifications and electrical data. These catalog sheets provide designers and users of electrical control equipment for hydraulic and pneumatic machinery with valuable information on the selection of control components.

Circle 221 on Reader Service Card

PROCESS PUMPS . . . Ingersoll Rand has published Bulletin 7277 which describes its line of AFL process pumps. These units in discharge nozzle sizes of 1, 1½, 2 and 3 inches, are cradle-mounted, vertically split casing pumps suitable for a wide range of medium duty services found in modern refinery and process pumping applications, and for services to 500 degrees F, 300 psi and 500 gpm. The pumps are equipped with a gear-type coupling and are suitable for either motor or turbine drive. Construction data and dimensions are included.

Circle 222 on Reader Service Card

STEEL PIPE AND TUBING . . . Alloy tubing steels widely used in elevated temperature service is discussed in a new technical data card, No. 146, issued by the Tubular Products Division of the Babcock & Wilcox Company. The bulletin discusses Croloy 5, this steel is particularly resistant to corrosion from hot oil and has proven its value in refinery and other process industry applications. Included are data on mechanical properties, creep strength, physical properties, welding, fabrication and heat treatment.

Circle 223 on Reader Service Card

AIRCRAFT HYDRAULIC PUMP . . . Bulletin A 5206 has been prepared by Vickers Incorporated describing their line of thirty-four standard sizes of 3000 psi constant displacement aircraft hydraulic pumps. The completeness of this line simplifies installation problems, provisioning and servicing. A sectional photograph outlines all the features of the pump and specifications are detailed.

Circle 224 on Reader Service Card

Circle 120 on Reader Service Card

ULRIX

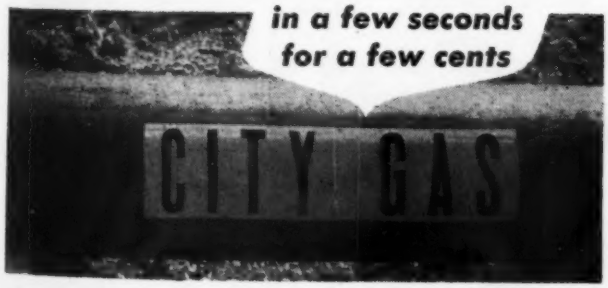
QUICK COUPLERS
For All Hydraulic Lines

What's Your Hydraulic Line Problem? There's an answer in the ONLY COMPLETE SELECTION

ULRIX offers a model and size for any problem — standard and break-a-way types. ULRIX QUICK COUPLERS connect under pressure without tools. WRITE for FULL DETAILS.

ULRICH MFG. CO. ROANOKE, ILL.

ELIMINATE DANGEROUS UNMARKED PIPE...



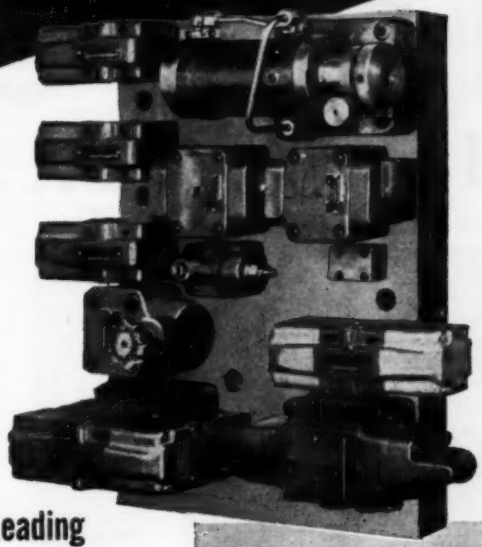
Easy-to-read wording, plus color, tells anyone instantly, without the need of costly painting or difficult stenciling. Inexpensive Tel-A-Pipes are wrapped around pipe in a few seconds by unskilled help. They adhere permanently, will not curl off indoors or out. No longer need the important job of marking pipe in your plant be a major project.

Printed in more than 800 stock descriptions or your specifications, on durable fabric, Tel-A-Pipes with Hi-Tack self-adhesive backing permanently adhere with fingertip pressure. Tel-A-Pipe's exclusive method of application is not only faster, but assures a more permanent bond. Available in 4 stock sizes. Save by getting exact size *you* want.

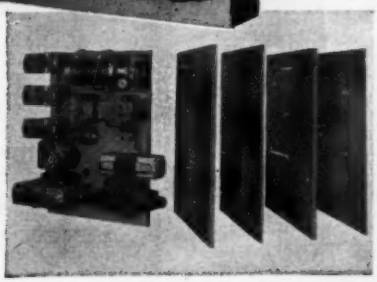
WESTLINE *Tel-A-Pipes* *Write Dept. AH-3*

Western Lithograph Co., 600 E. 2nd St., Los Angeles 54, Cal.

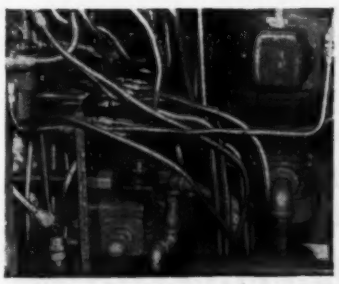
ENGINEER *Simplicity* INTO YOUR HYDRAULIC EQUIPMENT CONTROL SYSTEMS



Leading Hydraulic Manufacturers Are Using Almo Manifolds to Cut Costs and Obtain Permanent Trouble-Free Operation



Almo has perfected the manifold method of channelling hydraulic fluids at high pressures after years of research and can apply it to your equipment. Send a diagram of one of your present hydraulic circuits. Without obligation we will return an Almo Manifold diagram demonstrating how the job can be completely simplified.



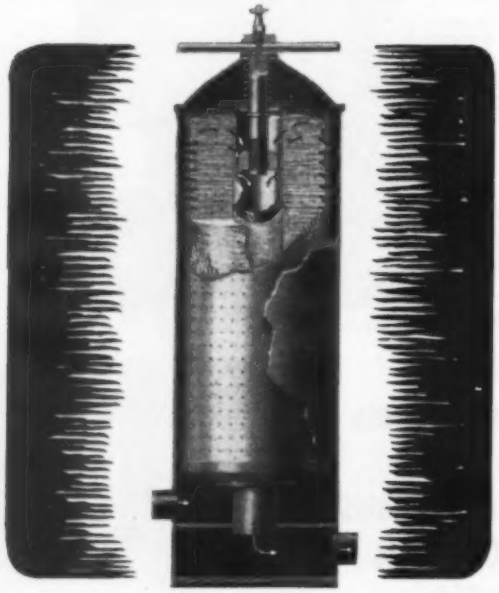
This maze of piping and tubing, all subject to failure resulting from vibration and deterioration, can be eliminated and made as compact and simple as the unit illustrated above.

Write for our new brochure

ALMO TOOL CO.

3327 E. VERNOR • DETROIT 7, MICH.

Prevent
Sludging
Pump, valve and piston failures
with
HILCO
OIL FILTERS



SERIES "R" FILTER

Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO filters . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO filters.

Years of experience and dependable service make **HILCO** your best filter buy.

★ *Recommendations at No Obligation*
FREE Descriptive Bulletin

THE HILLIARD CORPORATION
148 W. FOURTH ST. • ELMIRA, N. Y.

IN CANADA: — UPTON - BRADEEN - JAMES, LTD.
990 Bay Street, Toronto — 3464 Park Avenue, Montreal

USEFUL LITERATURE

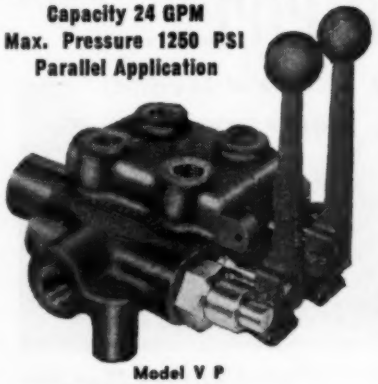
SELF LOCKING NUTS . . . A 4 page bulletin on self locking nuts has been prepared by Standard Pressed Steel Co. The locknuts are one piece, all metal, they lock and stay put on a threaded member. Can be used as stop nuts because they will stay put at any point on a bolt or stud. Steel nuts are unaffected by temperatures up to 550 degrees F and corrosion-resisting steel nuts up to 750 degrees. These nuts can be used on automotive equipment, steel making equipment, electrical and materials handling equipment and many other industrial applications.

Circle 225 on Reader Service Card

HOW TO SOLVE PUMPING PROBLEMS... That's the title of a 36 page catalog covering rotary gear type pumps manufactured by Geo. D. Roper Corporation. This attractive, illustrated catalog is divided into three sections,: introduction, giving general explanation of rotary gear pumps and factors of pumping problems, section 2 showing three sample problems and section 3 technical data. Section 1 gives a most detailed outline of the pumps and their application, liquid to be handled and characteristics. The sample problems include a hydraulic system, a general transfer and a pressure transfer. The problem

And Now-A Gre-Sen
MULTI-CONTROL VALVE

Capacity 24 GPM
Max. Pressure 1250 PSI
Parallel Application



Model V P

Another Gre-Sen Engineering Triumph In Quality Hydraulics at Mass Production Prices.

For Mobile and General Industrial Applications.

FEATURES - - -

- **Fully Balanced—Self Centering—Built-in Adjustable Relief Valve.**
- **Relief Valve Has Replaceable Hardened Seat**
- **Tripod Mounting Feet**
- **Check Valve Effective On All Spools**
- **Smooth Positive Easy Control**
- **Hardened and Chrome Plated Spools**
- **Two Position Control Handle 180°**

Center sections are available making additional Controls in this Multi-unit.

Write for full details about this better built, money saving valve.

GRE-SEN MANUFACTURING COMPANY
628 Colfax Ave. N. Dept. H-53 Minneapolis 11, Minn.

is discussed step by step with formulas given in order to arrive at the solution. The technical data section, the largest in the book covers cylinder displacements, viscosity conversion charts, temperature conversion table, electrical data, materials of pump construction and many other important listings. This catalog will be a useful addition to the library of design engineers and those dealing with the selection of pumps.

Circle 226 on Reader Service Card

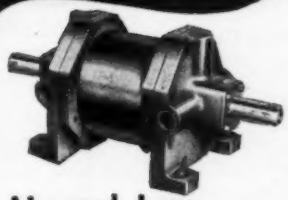
OIL HYDRAULIC EQUIPMENT . . . Gear pumps, oil motors, control valves, cylinders, pump-valve-tank combinations and auxiliary valves are described and illustrated in Bulletin No. 101A, offered by Hydreco, Division of The New York Air Brake Company. Also shown are typical industrial applications.

Circle 227 on Reader Service Card

AIR AND HYDRAULIC VALVES . . . Bulletin 1000 describes and illustrates the complete line of valves made by Ledeen Manufacturing Co. These valves, embodying disc type construction are used for operating air and hydraulic cylinders both single and double acting, and air motors. They are available in hand, foot, pilot and solenoid operated models.

Circle 228 on Reader Service Card

GET THESE FEATURES IN ALL YOUR FUTURE CYLINDERS



Hydraulic High Pressure

- ★ Centrifugally Cast Cylinder Bodies
- ★ Cast Steel or Semi-Steel End Caps
- ★ Cast Iron Piston with Automotive Type Rings
- ★ Leakproof Packing. "O" Rings in each end cap
- ★ Adjustable Port Location
- ★ Fixed Cushions Standard Construction — Adjustable Cushions Optional

Air and Low Pressure Hydraulic

- ★ Compact — No Tie Rods
- ★ Extra heavy walls of selected tubing
- ★ Metal to metal assembly preloads piston cups
- ★ Automatic rod packing requires no take-up. Seals under pressure
- ★ Aluminum alloy piston with steel cup retainer
- ★ Extra long rod guide

HYDRO-LINE CYLINDERS CONFORM TO J. I. C. STANDARDS

➡ FREE Additional Data

covering additional construction and performance features are included in this catalog. Write for your copy today. Ask for bulletin 350.

Hydro-Line

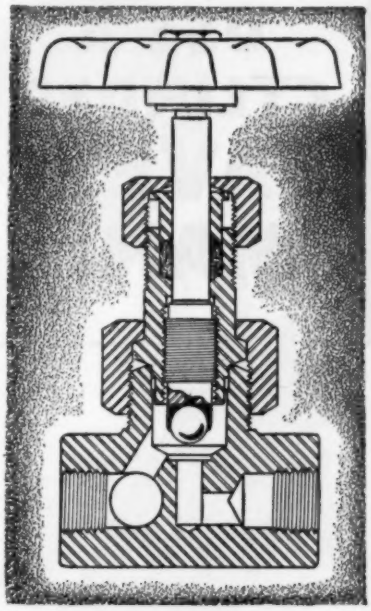
HYDRO-LINE MFG. CO.
705 19th Street
ROCKFORD, ILLINOIS

Circle 37 on Reader Service Card

NEW!

BALL VALVE

for liquids, gas or steam



Here's a radically-new forged steel valve for general heavy industrial use. Can't leak . . . practically never wears out . . . costs little or no more than ordinary valves!

In place of a disc or plug, the new Foxboro Ball Valve has a retained, free-rolling stainless steel ball that exposes new surface to seat at every closing.

Foxboro Ball Valves handle pressures to 3000 psi. Available in straight-thru and angle types. Two or four connections to simplify piping. ¼" size. Write for detailed folder. **The Foxboro Company, 215 Norfolk Street, Foxboro, Mass., U.S.A.**

FOXBORO INSTRUMENTATION
REG. U.S. PAT. OFF.

Get astonishing POWER and other unique advantages with GAST rotary AIR MOTORS

See our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

Write Gast, stating your specific problem or mention model that interests you.

Model 8 AM Up to 4 H.P. —only 6½" high (less muffler).

Model 4 AM Up to 1 H.P. —only 5¾" high (less muffler).

Model 1 AM Up to 1/6 H.P. —only 2½" dia., weighs 1½ lbs.

Model 2 AM Up to ½ H.P. —weighs approx. 5¼ lbs.

FOR YOUR ORIGINAL EQUIPMENT APPLICATIONS . . .

Gast rotary-vane Air Motors may solve tough problems on **your** product! They're lower in first cost, variable in speed, explosion-proof, quick starting, **amazingly** compact and light compared to electric motors.

Four sizes available, reversible and non-reversible ball bearing types, several mounting styles, speeds to 12,000 RPM. Numerous accessories. "Air may be your Answer!"

Original Equipment Manufacturers for over 25 years

GAST ROTARY — AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 138 Hinkley St., Benton Harbor, Mich.

USE A CYLINDER SAVE A MAN!

WHEREVER YOU HAVE TO...

PUSH or PULL
LIFT or LOWER
PRESS or SQUEEZE
TILT or TURN
OPEN or CLOSE

Ledeen cylinders used for air, oil, water, gas or steam operation with medium, heavy or super-duty models, provide a large number of variations and adaptations to meet your specific power or motion requirements. They are available in many diameters and stroke lengths with suitable head and rod attachments to provide almost any desired mounting.
Standard Ledeen cylinders and mountings from distributors' stocks in major cities. Special cylinders if required. All J.I.C.

WRITE FOR BULLETIN 500

VALVES • CYLINDERS
AIR-HYDRAULIC PUMPS & BOOSTERS
VALVE ACTUATORS • AIR HOISTS

Ledeen Mfg. Co.
1610 So. San Pedro
Los Angeles 15, Calif.

Circle 67 on Reader Service Card

USEFUL LITERATURE

FEED CONTROLLER . . . National Pneumatic Co., Inc., has prepared Bulletin DC-208-A describing their "Power Check" feed controller. The folder illustrates how the controller is applied to both manually and pneumatically operated drilling and milling machines. Available in strokes from 2 to 9 inches, having a pull capacity of 1000 pounds, the unit has a 2 inch diameter cylindrical body. Installation, adjustment and maintenance information is included in the folder.

Circle 230 on Reader Service Card

AIR OPERATED CONTROLLERS . . . Instruments for automatic control of pressure, temperature, liquid level, flow, humidity, horsepower, and electrical variables are described in a 32 page bulletin, No. A120, published by The Bristol Company. Among the new products described are time-program controllers and electronic Dynamaster Potentiometers and bridge instruments in air operated control models. The fully illustrated bulletin gives complete data on on-off, proportional, reset, derivative, reset plus derivative, and autoset types of controllers.

Circle 231 on Reader Service Card

SWIVEL COUPLING . . . A four page bulletin, Form 167, issued by Flexo Supply Company, Inc., describes the Flexo joint. Simple construction is one of the features. There are only three machined parts plus the seal, entirely enclosed and fully protected from dirt and grit. These joints can be used wherever it is necessary to convey steam, compressed air, oil, water, gas or other fluids through moving pipe lines. These joints are available in 4 styles, all of which are illustrated, and in all standard pipe sizes from ¼ up to including 3 inches, with female threads on both ends. Overall dimensions and installation data are also included.

Circle 232 on Reader Service Card

STAMP OF APPROVAL
ELDON
ELDORADIA WARE

KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A-12: A size 3 Kobe Triplex was installed in 1947 in the Los Angeles plant of the Eldon Manufacturing Company, makers of injection and moulded plastic products. The Triplex maintains a weighted accumulator at a pressure of 2650 psi to operate 17 plastic moulding presses of the plunger compression type. Service is on a 24-hour basis, 5 to 6 days a week.

"Start It and Forget About It"

"Red" Nash, Eldon foreman, praises the performance of the Kobe Triplex in these terms, "All you have to do with this pump is start it and forget about it. The only normal expense is to change oil every couple of weeks. The previous pump used required repacking every few days. This one is practically trouble-free".

Triplex Features

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
- Volumes—To 60 g.p.m.
- Power Ratings—15, 30, and 50 H.P.
- Integral Double Reduction Gears
- Integral Electric Drive (Optional)
- Easily interchanged Plungers and Liners

Write for Bulletin
KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

Circle 63 on Reader Service Card

TEMPERATURE CONTROLS . . . The Burling Instrument Company published a 4 page condensed catalog G-18, giving a general description of electric temperature controls, pictures of all models including the new models A-1S and B-1C, and a separate description of the company's pneumatic and valve type controls. A comprehensive selection and comparison table has been added showing the essential features of each of the 17 electrically operated temperature controls. Included are the one, two, and three switch models some of which are suitable for 1800 degrees F.

Circle 233 on Reader Service Card

CARBON STEEL . . . Peter A. Frasse and Co., Inc. offers a new chart with which carbon steel specifications can be identified in seconds. The chart shows chemical analysis requirements for each of 60 Military, Army, Navy, Aeronautical and Federal specifications. Also listed are specified forms, sheets, bars, etc. and nearest corresponding SAE, AISI, and AMS type numbers. Printed on dur-

Circle 234 on Reader Service Card

AIR CIRCUITS . . . For your file of circuit ideas, the Hannifin Corporation has prepared Data Sheet CD-1. The sheet shows six remote control air circuits for operating double acting cylinders. Operation and control components for each circuit are fully described.

Circle 235 on Reader Service Card

SMALL INDUSTRIAL PUMPS . . . An attractive 12 page 3 color catalog has been isued by the Tuthill Pump Company, featuring their model L line of mechanically sealed pumps for handling non-corrosive liquids, and designed to fill specific needs in lubricating, hydraulic, transfer and circulating services. Each pump is illustrated and dimensional diagrams shown, including a parts diagram.

Circle 236 on Reader Service Card

other uses

Measure acceleration and velocity. Trigger or synchronize cathode ray oscillograph sweep circuit angular position indicator (shaft or fly-wheel), reference marker (degrees, position or dead center). Indicate RPM, operations, cycles or motion at rates in excess of 20,000 per second when used with electronic counters.

ACCURATELY INDICATES

Rate of Motion at all Speeds

up to 20,000 per second *without* contact

Model 3010A

NEW

Electro ELECTRONIC EQUIPMENT ***IMPULSE GENERATOR***

Small low cost electromagnetic pick-up amplifies electrical impulses for counting recurring operations, revolutions, sequences, cycles or motions. It produces a voltage output proportional to the object's rate of speed. And may be actuated by the displacement or vibration of any magnetic material in the field of the pick-up. Such as a slot or keyway in the rim of a wheel or shaft, the teeth in a gear, or any magnetic part on a moving body.

Consult Our Engineers On Your Particular Problem.
Write for Bulletin MP 552 Today!

ELECTRO PRODUCTS LABORATORIES

4501-Hu North Ravenswood, Chicago 40, Ill. In Canada: ATLAS RADIO CORP., LTD., Toronto

MOST

FLEXIBLE VALVE

The series 3000 "Husco" Control Valves, "the valve with the horseshoe ports" (patents applied for) handles the great majority of control problems with a basically simple design. Its features include:

(1) Horseshoe or "U" port charged with high pressure through a single check valve; "U" low pressure port relieves all external seals and plunger plugs
(2) Balanced spool with built-in throttling characteristics for fine control
(3) Single or double acting plunger or combination operation
(4) Adjustable differential relief valve
(5) Valve bodies of chromium-nickel iron alloy; plungers and valve seats of specially treated alloy steel

Series 3000 Control Valves are available in ½, ¾ and 1 inch pipe capacity. Optional features for customer's selections are available on request.

HUSCO builds a complete line of single and double acting cylinders, differential type and telescoping cylinders. The line includes pumps (1500 psi to 5 gpm), and package power units.

HUSCO ®

Used on: Construction, Industrial Material Handling and Agricultural Equipment

HYDRAULIC UNIT SPECIALTIES CO.

Pumps • Valves • Cylinders

Waukesha, Wis.

Post Scripts of Industry

News about people, manufacturers and sales organizations

Les A. Shea
Lindberg Engineering Company

H. Bruce Rasmussen
Miller Motor Company

M. O. Cox
Flodar Corporation

Les A. Shea, general sales manager of **Lindberg Engineering Company,** Chicago, has returned after eight months in Washington as industrial representative in NPA. Upon his return Shea was designated to head the expansion plans and moving of Lindberg's Air Hydraulics Division to a new location.

H. Bruce Rasmussen becomes the new sales manager in charge of **Miller Motor Company's** coast-to-coast sales organization. He previously was associated with Baker Chemical Company for 19 years. Increased sales and service coverage in the Chicago, Detroit, and Cleveland areas has been accomplished by the addition of the following salesmen: **Jack Frink** and **John Vaas,** now working with **Roy Wilks** in the Chicago area; **Stephen Stiles** assisting **Jim Sprague** in the Detroit area; and **Roger Lawson** working with **Roland Kendrick** in the Cleveland-Akron-Youngstown area.

Monte O. Cox has been appointed chief sales engineer for **Flodar Corporation.** Cox is owner of the Cox Engineering & Sales Company of Detroit, Michigan, where he maintains a sales and service staff as sales representative for Flodar products in the state of Michigan.

A. D. Sullivan has been elected vice president in charge of engineering at **Brunner Manufacturing Company,** Utica, N. Y. Sullivan came to Brunner in 1945 as assistant chief engineer and was appointed chief engineer in 1947.

Air Associates Incorporated announced the appointments of **C. A. Sereno** as chief engineer of the corporation and **C. B. Terry** as general manager of the company's Electronic Equipment Division in Orange, N. J. Sereno, formerly chief engineer of the company's Aircraft Products Division in Teterboro, will now head up the overall engineering activities of the corporation. Terry, formerly chief engineer of the Electronic Equipment Division replaces C. K. Krause who has resigned.

F. N. Bard, president of **Barco Manufacturing Co.** announced, that after 25 years in Chicago, all of the company's manufacturing and business operations are now transferred to Barrington, Illinois, where Barco has erected a new, ultramodern 103,000 square feet plant. The new plant is located at 500 N. Hough St. It is planned for efficiency in manufacturing with all operations on one floor.

The Pesco Products Division of Borg-Warner Corp. has concluded an agreement with the **Dexter Folder Co.,** Pearl River, N. Y., for the purchase of Pesco's supercharger business, including all manufacturing, sales, engineering and service facilities. The Dexter Folder Co. will transfer Pesco's supercharger facilities to a new division to be

known as **Miehle-Dexter Supercharger Divison.** This division will be located in Racine, Wis., and all of its products will be manufactured by the Christensen Machine Co. of Racine, which is a wholly owned subsidiary of Dexter Folder Co.

The **Young Radiator Company** announced the appointment of The Paquin Company, 13405 St. Clair Avenue, Cleveland, Ohio, as sales representative in the Cleveland area.

Cyrus A. Poole was named chief engineer for **James-Pond-Clark** of Pasadena, California. Most recently engaged as a consulting engineer in the field of guided missile and wind tunnel design, Poole brings a broad engineering background of hydraulic pneumatic and servo control applications to the firm.

William R. Lockridge
The New York Air Brake Company

Hall Kirkham has announced his retirement as president of **Hydreco, A Division of The New York Air Brake Company,** Cleveland, Ohio. The title of president—Hydreco Division has been discontinued. Kirkham will continue as director of and special consultant for The New York Air Brake Company. **Edward J. Hrdlicka** was named as manager of the Hydreco Division. **William R. Lockridge**, formerly assistant secretary of Bendix Aviation Corporation, has been appointed director of market development of the New York Air Brake Company. He will coordinate and direct overall sales and marketing policy for the company and assist in the appraisal of new company and new product acquisitions.

The **Circle Supply Company,** 2181 East Foothill, Pasadena, Calif., has been appointed Southern California distributor by the **Deutsch Company** of Los Angeles, manufacturers of industrial flared tube fittings.

Wm. J. Wagner has been appointed sales manager of the **Pump Engineering Company** of Los Angeles. He will place his major effort on centrifugal pump and blower applications. Wagner for the past 25 years has been associated with pump manufacturers, more recently with Tuthill Pump Company, Chicago.

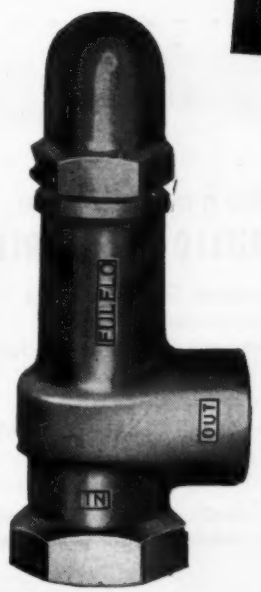
Duanne R. Lamiman has been named district sales manager of the New York office of **United States Gauge, Division of American Machine and Metals, Inc.,** Sellersville, Pa. The New York territory comprises New York state, New England and Northern New Jersey. Headquarters are in the Woolworth Building, New York.

Engineers agree that the BEST designs are the SIMPLEST

EFFICIENTLY SIMPLE

TRADE MARK "FULFLO" REG U S PAT OFF

OIL BY-PASS RELIEF VALVES



BRASS OR CAST IRON Standard or Flange Types

To maintain specific, predetermined pressures on machine tool hydraulic mechanisms, ram presses, Diesel and oil burning equipment.

NON-CHATTERING . . . NO MAINTENANCE. INSTALL . . . THAT'S ALL

for pressures from 0 to 500 lbs. Pipe sizes from ¼" to 2".

WRITE on your letterhead for your personal, professional copy of valuable, information-packed FULFLO MECHANICAL DATA BOOK

FULFLO

THE FULFLO SPECIALTIES CO. Inc.
BLANCHESTER, OHIO

Post Scripts of Industry

Continued

Appointment of **William M. Campbell** as manager of the Peoria, Illinois division of the **Hyster Company** has been announced. Campbell has been with the company since 1940, starting in the Portland, Oregon offices and later transferring to the Peoria Plant.

Harry E. Beane has been appointed vice president and sales manager of **The Bristol Company,** Waterbury, Conn. Mr. Beane joined the Bristol sales engineering organization in 1920.

The **Cleco Division of the Reed Roller Bit Company,** Houston, Texas, announced the appointment of: **Maintenance Services Company,** 112 Academy Street, South Orange, N. J.; **Detroit Supply Company, Inc.,** 113 South Brandywine Avenue, Schenectady, N. Y,; and **Sears and Bowers,** 411 Spring Garden Street, Easton, Pa., as distributors for Cleco products in their areas.

William C. Ridge has been appointed works manager in charge of manufacturing operation of the Trenton and Roebling, New Jersey Plants of the **John A. Roebling's Sons Corporation.**

Carl M. Higbie Jr. has been named president of the **Higbie Mfg. Company** of Rochester, Michigan, succeeding his father, C. M. Higbie, who became chairman of the board. Several other appointments have been effected in the Avon Tube Division. **E. P. Robinson,** formerly sales manager, has been made vice president in charge of sales for all fusion-weld steel tubing; **Norman G. Elliott** has been promoted to vice president of the Bronson Reel Division with headquarters in Bronson, Mich.; and **V. J. McAvoy** has been named treasurer of the parent company.

Richard N. Mathews has been elected vice president of **Kewanee-Ross of Canada Limited,** and placed in charge of the firm's new general offices at 57 Bloor Street West, Toronto. The recently formed company was established to provide engineering and sales service to Canadian industry.

The General Dynamics Corporation, which in April 1952, acquired the assets and business of the Electric Boat Company, has contracted to buy 400,000 shares, approximately 17 percent of the common stock, of the **Consolidated Vultee Aircraft Corporation** from the Atlas Corporation, an investment company,

clean HYDRAULIC OIL

STOPS downtime and costly repairs to hydraulic equipment

Honan-Crane
HYDRAULIC OIL PURIFIER

- Removes Solid Abrasive Contamination
- Removes Corrosive Products of Oxidation
- Prevents Sludging
- Keeps Oil CLEAN and SAFE to Use Indefinitely

Sizes for direct connection to individual machines—mobile units for general service.

Get FREE Booklet

"Hydraulic Bulletin" describes profitable use of Honan-Crane Purification in many hydraulic applications. Write for yours!

HONAN-CRANE CORPORATION
102 Wabash Avenue • Lebanon, Indiana
A Subsidiary of
HOUDAILLE-HERSHEY CORP.

WORLD'S LEADING OIL FILTER MANUFACTURER

All Honan-Crane equipment is sold on a performance guaranteed basis

In Canada: E. W. PLAYFORD, LTD., Montreal 28
W. E. MICKLETHWAITE, Toronto 18

The Superiority of Periflex Packings begins with Mold Engineering!

IT'S THE LIP TAPER

Let us send our new catalog listing mold data.

Sufficient interference to produce an efficient seal and at the same time minimum frictional drag on moving surfaces has been accomplished by Periflex. Careful attention is given in our shop to maintain close tolerances and special design features in mold manufacture.

Periflex Inc.

HAZEL PARK • MICHIGAN

it was announced by John Jay Hopkins, chairman and president of General Dynamics and Floyd Odlum, president of Atlas. This will constitute the largest block of "Convair" stock in the hands of one holder.

Hal Ernst
Blackhawk Mfg. Co.

The appointment of **Hal Ernst** as sales manager of the Hydraulic Control Division of **Blackhawk Mfg. Co.**, was announced by R. C. Wacker, general manager of the division. Since September 1949 Ernst served as a field representative for the equipment division. He will be responsible for the merchandising of hydraulic equipment to concerns who incorporate hydraulics into the manufacture of their own equipment.

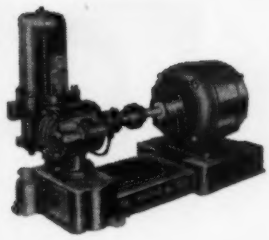
Oliver Iron and Steel Corporation has announced the location of a new general sales office at the Oliver Building, Pittsburgh 22, Pa.

Hanna Engineering Works, Chicago, announced the appointment of a new sales representative in the northern Indiana territory, **The Barton Sales Company,** 1609 West Third Street, Fort Wayne, Indiana. The company will handle sales in Northern Indiana including the cities of Fort Wayne and South Bend. The company is headed by **Owen Barton,** who has had years of experience in the pneumatic and hydraulic cylinder field.

KRAISSL

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289 for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL KRAISSL CO

305 Williams Avenue, Hackensack

Post Scripts of Industry

Continued

John G. Spotton Company, Ltd., APPLIED HYDRAULICS Franchise distributor for the Toronto area, has moved to new and larger quarters at 21 Carson St., Toronto 14, Canada.

W. J. Holden
Honan-Crane Corporation

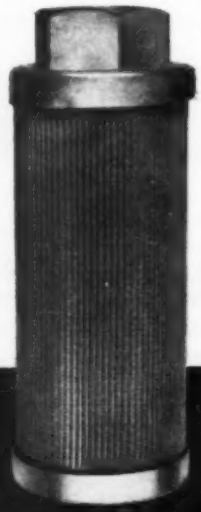
After serving as **Honan-Crane** resident engineer in the central New York area, **Walter J. Holden** has been appointed assistant to the general sales manager at Honan-Crane's home office in Lebanon, Indiana.

Graton & Knight Company of Worcester, Mass., moved their Chicago office from 164 North Wacker Drive, to 546 West Washington Boulevard, Chicago 6. This office will continue to be under the management of **Arthur M. Norris,** district manager.

Joseph J. DeWindt and G. C. Vogel have been named assistant works manager and general superintendent, respectively, at the **Allis-Chalmers** Norwood (Ohio) Works. DeWindt with the company since 1927, steps into the post recently vacated by the promotion of **J. F. Costigan** to works manager. **John P. Kelley** has been named works manager of the Boston Works. Kelley had been superintendent of production, stores and scheduling for the last year. **Joseph L. Desmond** has been appointed to succeed Kelly as superintendent of production and will continue in his present post as traffic manager. Also named to new posts are **Samuel R. Stubbs,** to be in charge of the plant's time-study, methods, planning, tooling, and cost analysis departments; **Francis Jackson,** to supervise the tool design department; and **N. William Morelli,** to be in charge of the plant engineering department. **Alfred E. Schuler** at present general foreman of the machine shops, will also supervise the experimental and tool departments.

Promotion of **George A. Fort** from manager of quality control to general manager of the Rubber Division of the **Parker Appliance Company,** Cleveland, was announced. Fort succeeds

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



The New
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT
Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
EASY TO INSTALL · EASY TO CLEAN · LONG LIFE · LOW COST
SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

HAND HYDRAULIC PUMP

Single and Double Designs To 20,000 P. S. I.

- Dual Pump Unit Reservoir. 360 cu. in.
- Interchangeable Pistons
- Interchangeable Pistons 3/8-1/2-3/4 inch

Pressure range is 3,000 to 20,000 P.S.I. Pipe connections 1/4" N.P.T. Handle length is 18 inches. Weight is 8 to 18 pounds. Unit can be bolted or welded into position. "We specialize in hand pump units to operate in temperatures from minus 65 F to plus 160 F and with any capacity reservoirs required."

WILLIAM S. PINE
1637 E. 22nd St., Los Angeles 11, Calif.

Circle 16 on Reader Service Card

Circle 86 on Reader Service Card

Edward W. Hollis who was appointed district manager of a new industrial sales office opened by Parker in Cleveland. Succeeding Fort as manager of quality control will be **Anthony Fedewitz** formerly chief inspector.

Albert B. Diss has been named vice president and general manager, **The Watson-Stillman Company,** Division of H. K. Porter Company, Inc., Roselle, N. J. Diss in his new position will be in complete charge of all manufacturing and sales operations.

A. M. Sargent, founder and former president of the Pioneer Engineering and Manufacturing Company who recently resigned his interest in that firm, announced the opening of his own consulting engineering office at 10120 West McNichols Road, Detroit, Michigan.

Anthony D. Bogus
Young Radiator Co.

Anthony D. Bogus, sales engineer, has been promoted to assistant sales manager of the Industrial and Oil Field Division of **Young Radiator Company.** In addition to his new responsibilities, Bogus will continue to handle sales and engineering of oil field and heat transfer equipment.

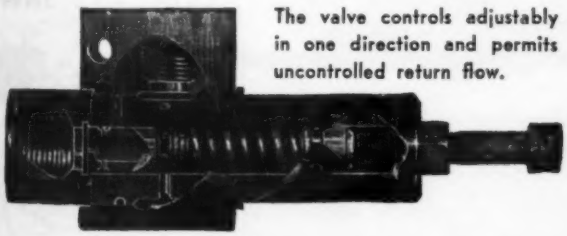
Rivett Lathe & Grinder, Inc., has appointed **Lane Engineering Company,** 1807 Elmwood Ave., Buffalo 7, New York, as representative in the Buffalo district. **Clifford J. Lane** is head of the company.

The board of directors of **Titeflex, Inc.,** Newark, N. J. announced the following promotions: **Henry S. Elder** to executive vice president; **George K. Licht** to vice president in charge of production at the company's two plants in Newark; **John J. Phillips** to vice president in charge of sales and engineering. In his new position he will consolidate and coordinate the company's sales activities with its engineering operations.

Myron S. Curtis, for the past four and a half years director of engineering of the **Warner & Swasey Company,** has been elected engineering vice president.

An adjustable FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

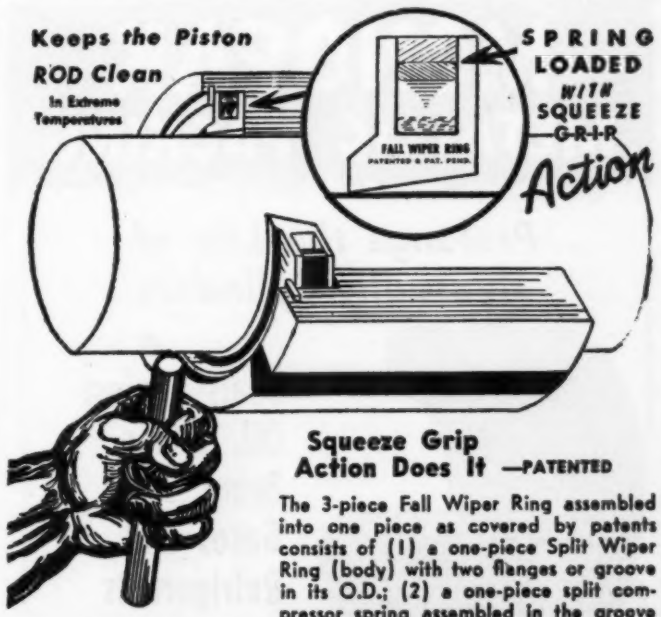
Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4½ to 7½ inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular A

WATERMAN ENGINEERING *Company*
725 CUSTER AVENUE
EVANSTON, ILLINOIS

Keeps the Piston ROD Clean In Extreme Temperatures

SPRING LOADED WITH SQUEEZE GRIP Action



Squeeze Grip Action Does It —PATENTED

The 3-piece Fall Wiper Ring assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Ace Products Company
Toledo 1, Ohio Phone ADams 6513

Used During World War II and ever since by the Military

Fall Wiper Rings Spec. MIL-S-5049 are AN Approved.

Covered by patents issued and patents pending

In Use Since 1944

Fall Wiper Ring SPRING LOADED

Post Scripts of Industry

Continued

The **H. F. Black Equipment Company,** Cleveland distributor for the Elwell-Parker Electric Company, appointed **John R. Hogan** as sales agent for Northeastern Ohio and Erie, Pennsylvania.

Jack W. Harvey, formerly assistant sales manager in charge of the Chicago territory for the **Manco Manufacturing Company** of Bradley, Illinois, has been named sales manager for the firm. He will be in charge of the firms expanding activities in the hydraulic tool field.

Malcolm S. Clark, president of **Snap-Tite, Inc.** of Union City, Pa., announced the election of **Armand A. Probeck** as vice president of the company.

Gilbert J. Schuelke
Chain Belt Company

Chain Belt Company of Milwaukee named **Gilbert J. Schuelke** as assistant sales manager of its Chain and Transmission Division. Schuelke started with the company in 1936 as an engineering apprentice, served in various engineering and sales assignments in the company's Milwaukee works, and in its district sales offices in Atlanta and Milwaukee. **John Sutcliffe** was named personnel manager of its Milwaukee works. Since joining the company in 1943 he served in the firm's Springfield, Massachusetts plant in the production, cost and personnel departments. **F. Dier Tincknell** was elected treasurer, succeeding George M. Dyke who has retired as treasurer after 30 years of service with the company.

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, announced the appointments of **Roy O. Johnson,** metallurgist, and **Charles W. Eastman,** industrial engineer. Johnson was formerly associated with Fairbanks Morse & Co., where he was a chemist, metallurgist and chief metallurgist. Eastman in charge of methods, time study, tool design and estimating at H-P-M, has had 20 years industrial experience with Indiana companies.

MONOPAK METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders

Seals against Oil, Water, Brine, Air, Gases and Refrigerants

ASSURES UNEXCELLED DURABILITY

Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

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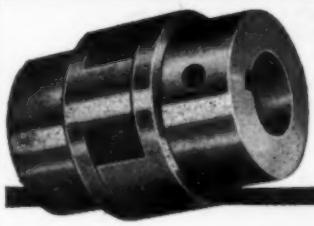
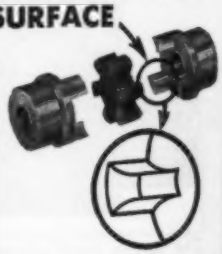
HYDRAULIC ACCESSORIES CO.
24301 HOOVER RD. • .VAN DYKE, MICHIGAN

NOT JUST ANOTHER COUPLING



GERBING'S *Exclusive* **CONCAVE JAW SURFACE**



The concave jaw surface of the new Gerbing Flexible Coupling actually holds the resilient synthetic rubber insert or spider in position, thus eliminating any tendency of the rubber to break or extrude. Capable of handling peak loads, shocks and overloads. Instantly compensates for angular and parallel misalignment.

Available for shafts ½" to 1⅞" and H.P. ranges from fractional to 25. Standard keyways are provided. A long-lasting vibration-free drive for a wide range of applications. Deliveries from stock.

Write for details

. . . holds spider in position at all times —No extruding!

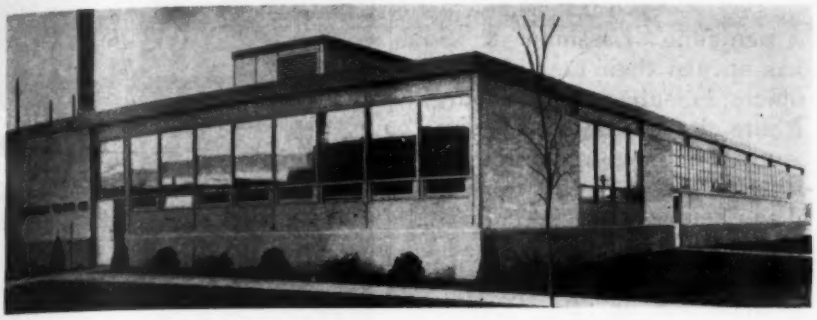
- **NO BREAKING OF SPIDER**
- **CLOSE CONCENTRICITIES ASSURE VIBRATION-FREE OPERATION**

GERBING MANUFACTURING CORP.
NORTHBROOK, ILL. (Suburb of Chicago) Dept. AH5

Circle 55 on Reader Service Card

Circle 135 on Reader Service Card

E. F. Houghton & Co. Forms New Packing Subsidiary



Construction of a new plant for the manufacture of synthetic rubber packings, and the formation of a subsidiary company for this purpose, has been announced by E. F. Houghton & Co., Philadelphia.

This new plant, already in production, is being operated as Houghton Vix-Syn Co., 140 Washington Street, South, Hopkins, Minnesota. It was built to provide additional manufacturing facilities in the middle and far west.

The building covers 12,000 square feet, and will be wholly devoted to the manufacture of homogeneous synthetic rubber packings, "O" rings and custom moulded rubber products. The site includes space for further expansion as needed.

This additional plant is necessary to take care of the constantly increasing demand for packings used to seal hydraulic and pneumatic mechanisms of all types, including presses, machine tools, automotive and aircraft hydraulically controlled devices.

William F. MacDonald, president of E. F. Houghton & Co., is also president of Houghton Vix-Syn Co. Sale of Vix-Syn rubber packings and custom moulded rubber products will be handled by E. F. Houghton & Co., whose main office and plant are in Philadelphia, with plants also in Chicago, Detroit and San Francisco.

Hydraulic Line Sold to Parker Appliance

The Parker Appliance Company of Cleveland has acquired in its entirety the JIC line of hydraulic accessories for machine tools formerly made and in process of development by the hydraulic division of Sundstrand Machine Tool Company, Rockford, Illinois.

The purchase was made known in a joint statement by S. B. Taylor, president of Parker and Bruce F. Olson, president of Sundstrand.

"We are acquiring all of the pumps and valves and special hydraulic units formerly built by Sundstrand for application to machine tools", Mr. Taylor said. "These products, all of which have been manufactured to the exacting requirements of the Joint Industry Conference on Hydraulic Standards will be augmented with additional developments already under way in our own industrial hydraulics division in Cleveland.

For the best in Custom Package Units insist on CENTURY reservoirs!

We specialize in 30 to 500 gal. reservoir units with any makes or combinations of commercial lines of pumps and valves to meet your needs.

Our units are designed to meet or surpass all "J.I.C." standards.

"If it's Hydraulic CENTURY Designs and Builds them"

Several styles from stock Write for Details

CENTURY HYDRAULICS, INC.

18135 JAMES COUZENS HIGHWAY • DETROIT 35, MICHIGAN

Solve Sludge Problem with Nicholson's

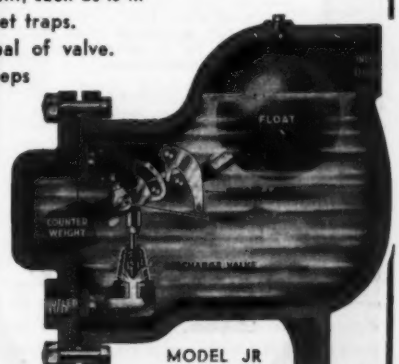
***New* AIR TRAPS**

With the introduction of an exclusive new oil-eliminating feature that prevents build-up of scum and sludge, Nicholson air traps now enable you to enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Other features of Nicholson air traps:

1) No air-wasting vent, such as is in all inverted bucket traps.
2) Positive water seal of valve.
3) Large orifice keeps valve clean, preventing blow-through.

Three types; pressures to 1500 lbs. For details send for

CATALOG 751



MODEL JR

213 Oregon St., Wilkes-Barre, Pa.

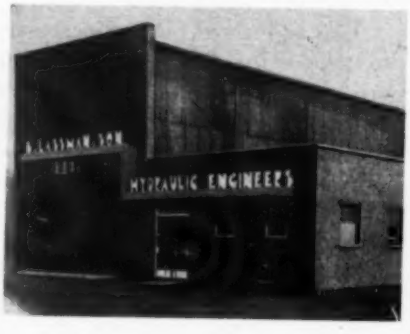
W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

How Do You Buy Bearings?
Do you get a MONEY-BACK GUARANTEE OF LONGER SERVICE AND LOWER MAINTENANCE COST?
You do when you buy
PROMET
THE Engineered BRONZE
BEARINGS
BUSHINGS
WEARING PARTS
Machined or rough cast
American Crucible methods, experience, know-how and equipment save you real money. Castings to your patterns—any size, shape or section up to 3,000 lbs. Pattern making, designing and machining.
PROMET
BRONZE BAR STOCK
Round, solid, tubular. Rough cast or fully machined. Cored stock, all sizes (by 1/8" steps) from 1/2" minimum core to 26" O.D. 13" lengths or less. 6 grades of hardness.
Write for literature or send blueprints, conditions of operation and other data for quotations and recommendations as to alloys.
THE
AMERICAN CRUCIBLE
PRODUCTS CO.
1303 OBERLIN AVE.
LORAIN, OHIO, U.S.A.

Lassman Opens New Plant

Benjamin Lassman & Son has opened their new plant and offices in suburban Pittsburgh, Route 8, Glenshaw, Pennsylvania. The new production facilities will permit the continued manufacture of special industrial hydraulic equipment as well as allow the inclusion of standard components in the Lassman heavy duty line. Benjamin Lassman remains in charge of engineering, L. Arthur Lassman heads up development and sales, and Martin Newcomer has been appointed works manager.



TEFLON
Back-Up Rings and "O" Rings
Mean
Longer Life
Better Performance
SPIRAL
"O" RING
SPIRAL
Teflon Spiral Back-Up Rings are now being used to replace many other materials because Teflon is almost completely chemically inert and is unaffected by acids, oils, solvents, etc. These rings are engineered to close tolerances to meet all required specifications. Immediate shipment on all sizes of Back-Up and "O" Rings. Write or wire now for complete specifications and prices.
REID RE Enterprises
2363 East 38th Street
Los Angeles 58, California

THE MARKET PLACE

SALES ENGINEER

Wanted in New York City area by solidly established firm expanding in hydraulic and pneumatic sales field. Unlimited opportunity for ambitious, qualified man. Write Box 5153 APPLIED HYDRAULICS.

SALES ENGINEERS
Oil-Hydraulic

HYDRECO, manufacturer of oil-hydraulic control equipment is expanding sales organization and has several openings for sales engineers experienced in oil-hydraulic field. Would be located at branch offices being established in eastern and mid-western industrial areas. Qualified engineers seeking permanent positions in sales engineering are invited to send in qualifications and compensation requirements to Hydreco a Div. of The New York Air Brake Co., 1100 E. 222nd St., Cleveland 17, Ohio.

PARKER HAND TUBE BENDERS
160 Complete Sets Available

Bender	Size	Present Net	Our Price
7-2829-A	7/16"	$19.03	$ 8.00
8-2829-A	1/2"	16.17	8.00
10-2829-A	5/8"	21.18	10.50
12-2829-A	3/4"	28.05	14.00
16-2829-A	1"	43.45	21.00

Complete set of (5) benders ($127.88 value) $55.00. John Ramsay & Son, 513 N. Madison St., Allentown, Pa.

HYDRAULIC ENGINEER WANTED

Rapidly expanding manufacturer of industrial and aircraft hydraulic cylinders and couplings requires the services of a young graduate engineer with some experience for its research and development division. Please send resume of education, experience and personal status to the Dukes Company, 2108 Southport Avenue, Chicago 14, Illinois.

AIRCRAFT HYDRAULIC SALES ENGINEER

Opening on Pacific Coast with headquarters in Los Angeles area for hydraulic sales engineer for nationally known manufacturer. Experience in Aircraft Engineering highly desirable. When replying please give background. State salary requirements and enclose recent snapshot. Box 5353 APPLIED HYDRAULICS.

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AIR-MITE Air Cylinders

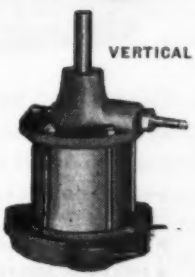
Single Acting

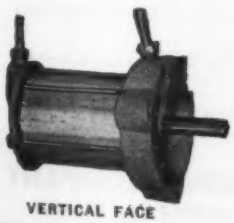
MICRO

Double Acting

CLEVIS

VERTICAL





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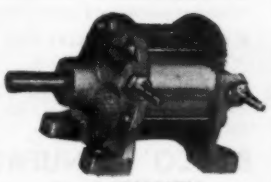

PARALLEL

Worth Their Weight in GOLDen Man-Hours

Save time, spoilage, cost . . . speed production . . . reduce fatique . . . on all drilling, reaming, tapping and processing jobs. Available in 1", 1½", 2¼", 3", 4" and 5" diameters; stroke length optional. Single or double action; all mountings.

Write for complete catalog of Air Cylinders and Air Arbor Presses.

AIR-MITE 4417-A West Carroll Ave. Chicago 24, Illinois

NEW SKINNER SOLENOID VALVE

EXPLOSION PROOF TYPE X5

THE new Skinner X5 Solenoid Valve is basically the same as the widely accepted and tested V5, but modified to a construction that is Underwriters' approved for Class I, Group D hazardous locations. Small size and lightweight features are retained, and the X5 is low in price because of the many parts which are interchangeable with other Skinner valves. Rating is 10 watts max.; soft, spring loaded seals prevent leakage; internal parts are stainless steel; wide variety of port locations in ⅛" and ¼" size; most types available for metering; for AC or DC in a wide range of voltages and frequencies; can be mounted in any position; supplied as two-way normally open or closed, three-way normally open, closed or directional flow. *Write today for detail:!*

SKINNER ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
105 Edgewood Ave., New Britain, Conn.

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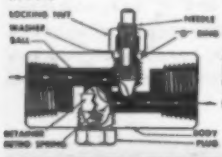
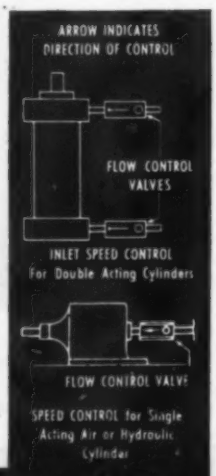
Get Easier, More Accurate Cylinder Speed Control with Pneu-Trol VALVES IN AIR OR HYDRAULIC USE

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Improved "O" Gland structure seals and locks the fine needle setting when speed adjustments are made. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Pneu-Trol Flow Valves are available in 5 female pipe sizes — ⅛" to ¾". Valve bodies are made from brass, aluminum, steel or stainless steel.



Attractive Prices — Immediate Delivery Write for Illustrated Circular and Price List.


ARROW INDICATES DIRECTION OF CONTROL
FLOW CONTROL VALVES
INLET SPEED CONTROL For Double Acting Cylinders
FLOW CONTROL VALVE
SPEED CONTROL for Single Acting Air or Hydraulic Cylinder

Pneu-Trol Devices, Inc.
1426 N Keating Ave., Chicago 51, Ill.

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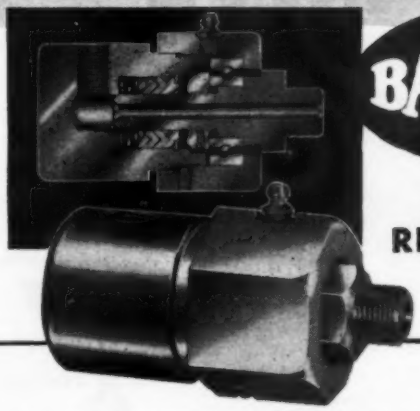
For High Speed Rotating Connections on
SPINDLES • CHUCKS • CLUTCHES



BARCO

TYPE V REVOLVING JOINTS

Use Barco TYPE V Revolving Joints wherever you need high speed, low torque, leakproof rotary connections for air or hydraulic lines on machine tools.

- **LIGHT RUNNING!** Ball bearing design handles both radial and light end thrust with low torque and minimum wear.
- **LEAKPROOF!** Thanks to Barco's exclusive "CTR" V-ring type seal.
- **PRECISION-BUILT!** All parts machined to close tolerances. Parts interchangeable and renewable.
- **COMPACT, DURABLE!** Easy to install where space is limited. Withstands rugged service.
- **WIDE SPEED RANGE!** Up to 2500 RPM on light pressure applications. Lower speeds for high temperatures and pressures. *Send for Catalog 300.*

BARCO MANUFACTURING COMPANY
532 F HOUGH ST. • BARRINGTON, ILLINOIS

Circle 11 on Reader Service Card

SIMPLICITY in hydraulic pump design is important for these reasons:

The Pesco hydraulic pump is a gear design—the simplest of all hydraulic pumps. There are actually only three moving parts in the pump proper. Fewer moving parts mean—

. . . less chance of pump malfunction
. . . less maintenance
. . . less cost for overhaul
. . . less weight
. . . less noise

plus the EFFICIENCY of "Pressure Loading" which makes possible:

"*Pressure Loading*" is Pesco's exclusive development that *automatically* holds end clearance of gears to a thin film of oil, thereby maintaining the volumetric efficiency throughout the long service life of the pump.

. . . volumetric efficiencies up to 97% over a wide range of temperatures

plus STATISTICAL QUALITY CONTROL which assures:

. . . uniform high quality and performance of each pump
. . . a longer, trouble-free service life

Simplicity of design, *efficiency* of "*Pressure Loading*" and *statistical quality control* in all phases of manufacture, are three important reasons why Pesco pumps are standard equipment on military and commercial aircraft and on many automotive and industrial products. Write today regarding your hydraulic pump requirements.

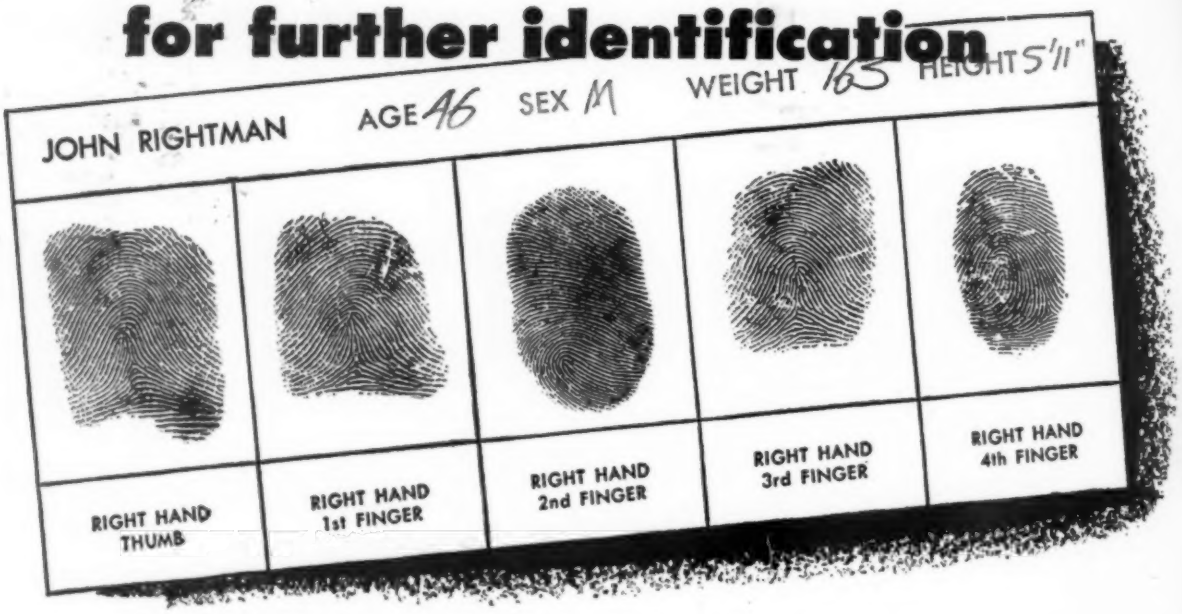
engineering Pesco production
PRODUCTS DIVISION

BORG-WARNER CORPORATION
24700 NORTH MILES ROAD • BEDFORD, OHIO

Circle 85 on Reader Service Card

WANTED!

for further identification



You can't identify a "buyer" by his fingerprints, his title, or the way his name appears in a directory. Moreover, you can't be certain of reaching the men you want with your advertising just because they are on a subscription list.

From the day you start your program, those "wanted" men may have passed away, secured new jobs, or been "fired". The new men that take their places may not see your message for a *year!*

How can your advertising avoid being a victim of the industrial mortality which yearly makes obsolete over 30% of the names on any list? How can you be sure that the message you pay for is reaching a live audience of men *identified as buyers?*

FRANCHISE CIRCULATION KNOWS!

(C. C. A. Audited)

In many important markets, obsolete circulation is not a "necessary evil"— — because there is a method that delivers your advertising message only to authenticated buyers. It's called "FRANCHISE CIRCULATION" (C.C.A. AUDITED).

In each market covered by the publications listed below, there are local distributors, wholesalers or agents who know the buyers better than anyone else . . . because they make their living by constantly calling on these buyers! They not only know the names of the individuals but are immediately aware of any changes in plant personnel or needs. Through the FRANCHISE CIRCULATION methods these changes are reported and verified daily! No wonder FRANCHISE CIRCULATION produces exceptional results for advertisers— it eliminates the unwanted names . . . delivers *active buyers!*

Write for free booklet "How Franchise Circulation Operates".

INDUSTRIAL PUBLISHING COMPANY
1240 ONTARIO STREET • CLEVELAND 13, OHIO
Member C.C.A.